CHNOLOGY DEPT.

The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. LV
No. 1417

SATURDAY, AUGUST 24, 1946

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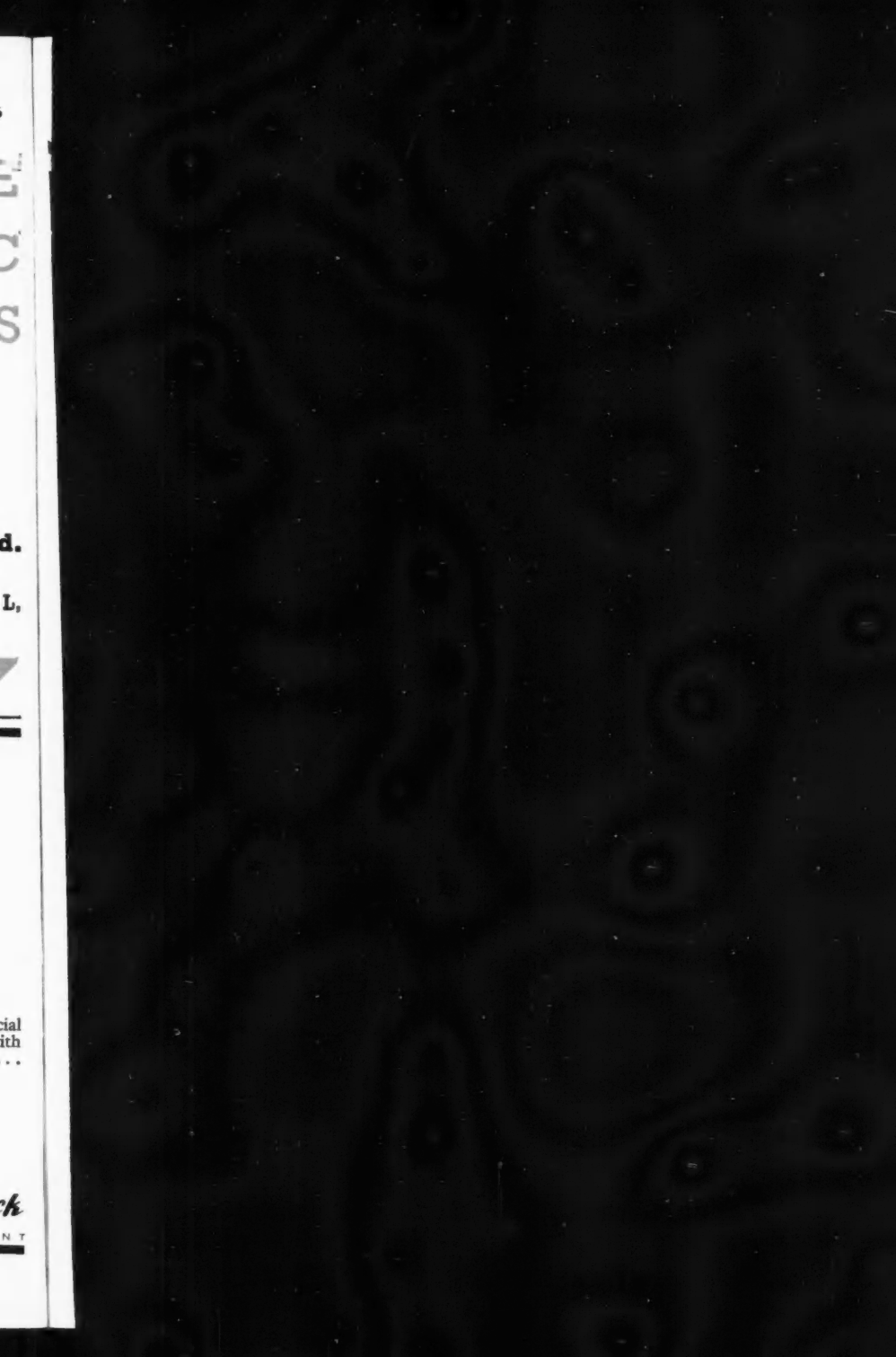

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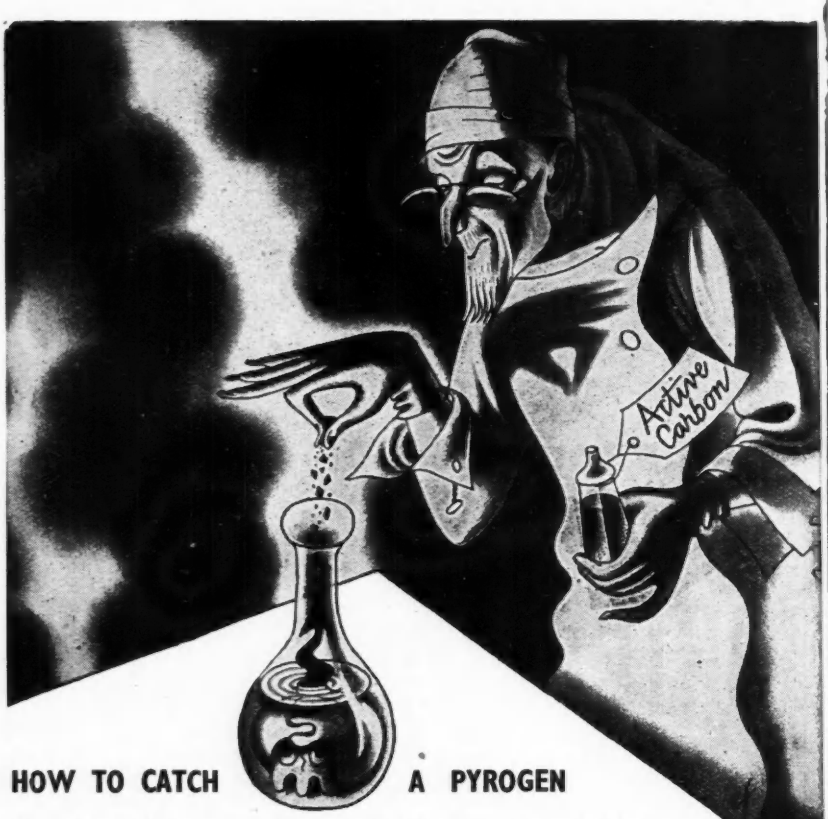

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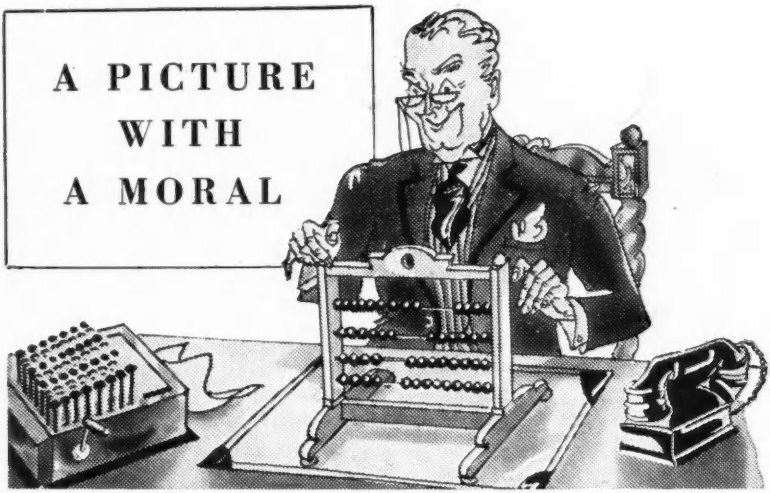

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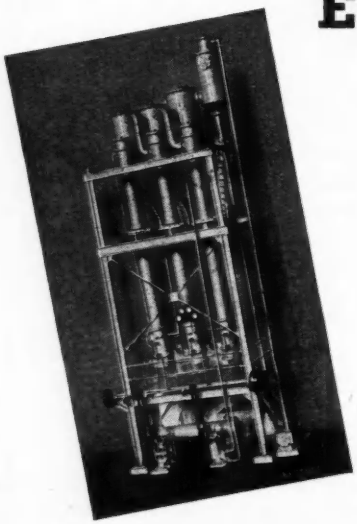

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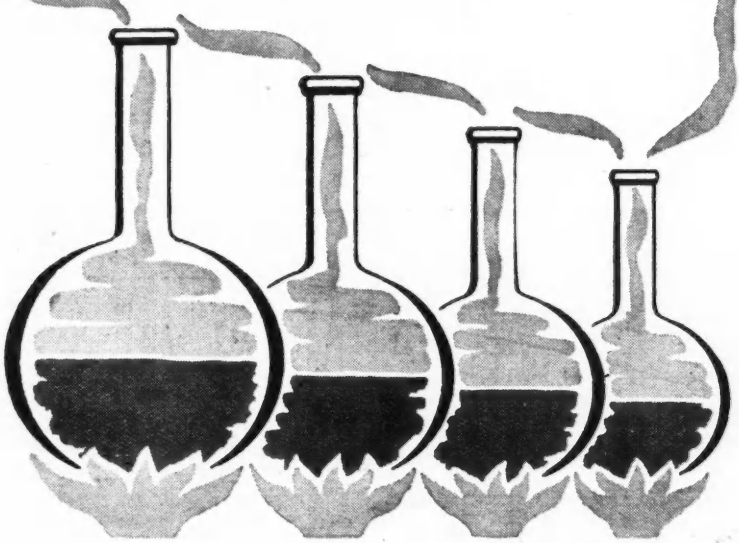

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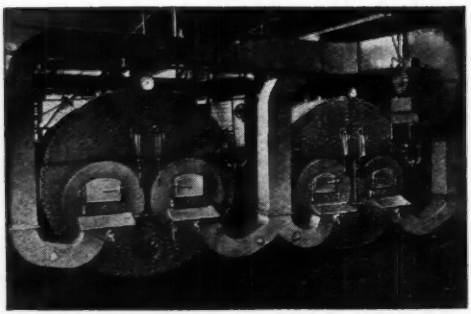

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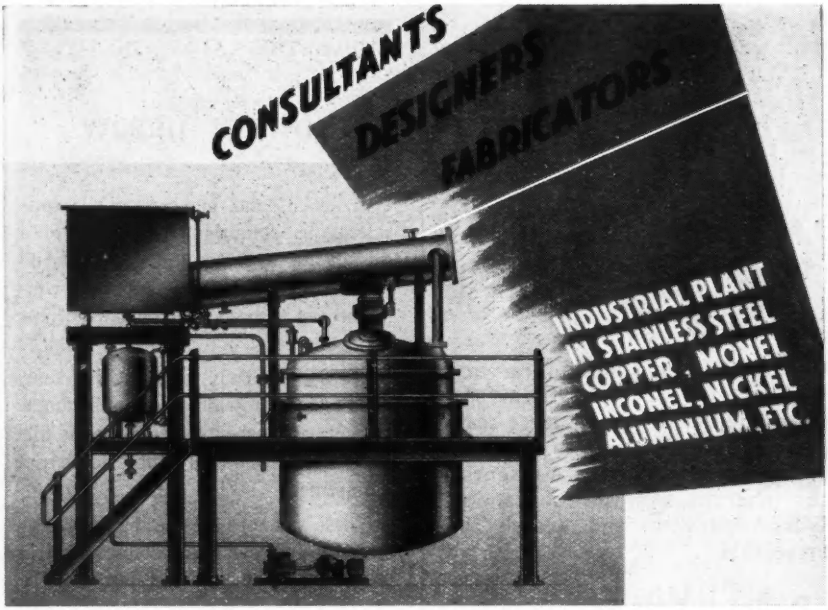

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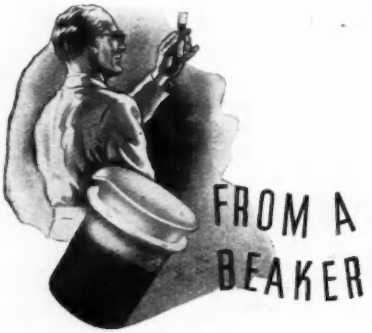

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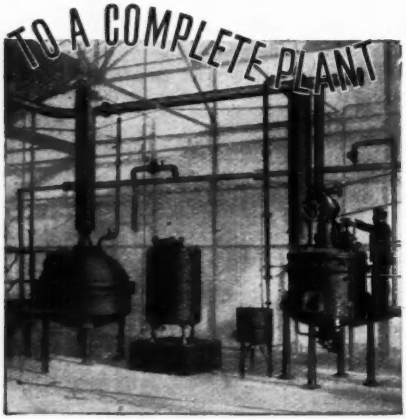

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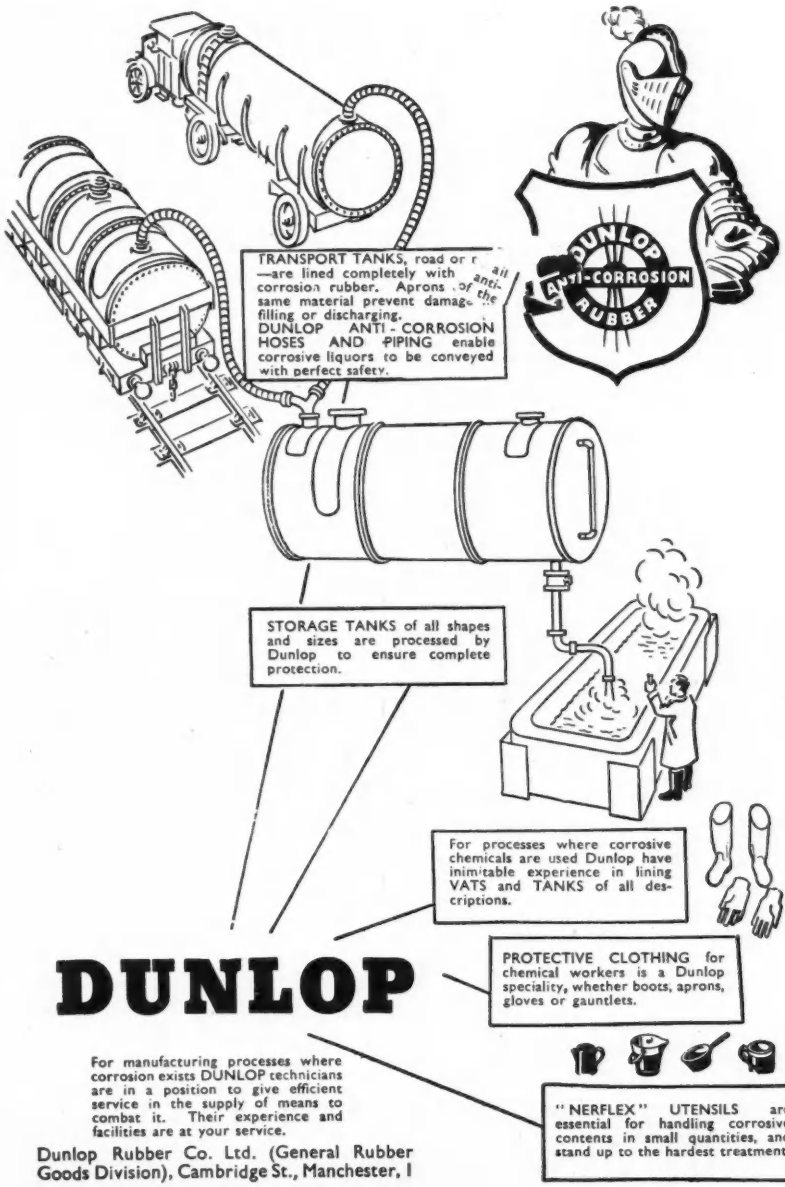
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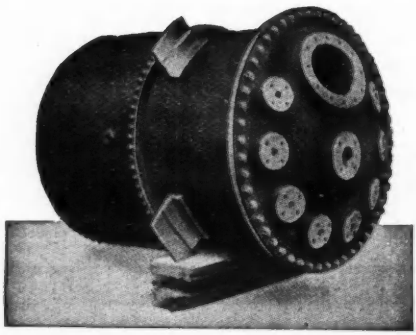

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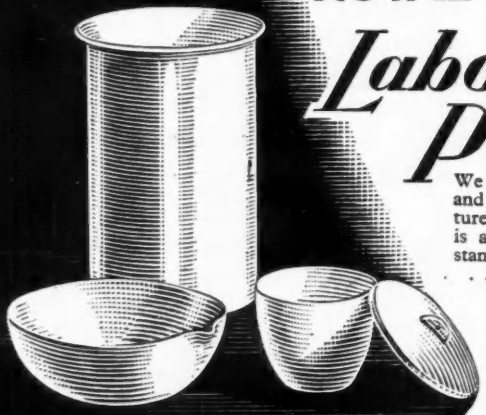

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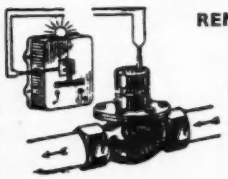

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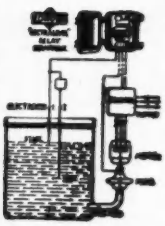

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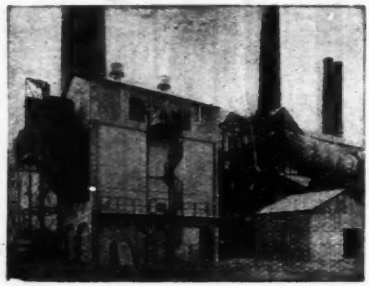

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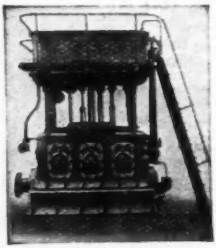

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Industrial Jewels

"ART and nature thus allied, go to make a pretty bride," sang W. S Gilbert in *The Mikado*. Mankind has ever sought for precious stones for adornment. The fabulous sums that are paid for jewels of the highest quality, the skill with which Indian princes for generations past have amassed quantities of priceless stones, even the legends of death and disaster that surround certain well-known gems, all bear testimony to the high regard which human beings have for these baubles. The comparative rarity of these minerals, and the fact that they were found only in Nature and could apparently by no means be made in the laboratory, enhanced their value. There is a difference between a diamond and a glass or "paste" crystal form of the same size and shape, but it is a difference that often needs an expert eye to detect. It is easy to deceive the inexperienced by substituting a paste stone for a diamond. Why, then, is the diamond so much more highly valued as a means of adornment? That question is exceedingly difficult to answer, but the fact that it is so has caused efforts to be made to manufacture diamonds in the laboratory. If we ask, however, why the diamond is more valuable for industrial purposes than the imitation, the answer is immediately obvious. It lies in the hardness of the real mineral as compared with the comparative softness, and lack of wearing power, of the imitation article.

The diamond has resisted all efforts to manufacture synthetic stones of the same composition and quality in the laboratory. That statement may appear to be too sweeping, for it is often maintained that Hannay succeeded in 1880. His experiments were described in the *Proceedings of the Royal Society* in 1880 and 1881, and there is in existence in the Natural History Museum in South Kensington a collection of fragments which are reputed to be the artificial gems produced by him. Many deny that these are in fact Hannay's productions. The most remarkable piece of evidence that, if not of Hannay's manufacture, they had at least an unusual origin, is the fact that some of the twelve pieces in the collection possess the rare structure characteristic of the type II class of diamond; this is a mosaic, less perfect, type of structure than that of the more numerous type I diamonds. Textbooks usually give to Moissan the honour of manufacturing synthetic diamonds by melting a mixture of pure iron and carbon at 4000°C. and plunging the molten mass into water; some of the carbon was said to have been recovered in the form of boart, black

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diamonds used for industrial purposes, and a few microscopic transparent diamonds were also found. Not one of these diamonds has survived, unfortunately. Later experiments repeating Moissan's work have produced materials of similar appearance, which have been shown not to be diamonds. Sir Charles Parsons made many attempts to produce artificial diamonds for industrial purposes during the 1914-18 war, but to no avail. We are left with the belief that in spite of these and other claims to have produced true diamonds by laboratory methods, no one has yet succeeded in doing so and in proving that he has done so. Important as the diamond is for industry, therefore, we are still dependent upon Nature for our supplies.

The diamond is not the only industrial stone, however. Although considerably less hard (yet still possessing a hardness of 9 on Mohs' scale) certain crystalline forms of aluminium oxide are very important. These are notably the sapphire, the ruby, and corundum. There are available blue sapphires, rubies, and "white sapphires," all crystalline forms of Al_2O_3, the two former being coloured by certain impurities which have become incorporated in the crystal lattice. The hardness of these stones makes them valuable for jewelled bearings in instruments, including watches. Stones which comprise a heterogeneous assemblage of crystals are of no use for this purpose; the crystal structure must be perfect. The reliance upon Nature for industrial sapphires failed to provide sufficient jewels at a reasonable price, and science was called in to produce stones more perfect than many of those found as natural minerals. The solution of the problems of manufacturing synthetic sapphires was due to Verneuil in 1902, and his experiments have been developed into industrial processes on the Continent, notably in Germany and Switzerland.

One of our minor war-time achievements was described in a recent paper by Mr. H. P. Rooksby, of the Research Laboratories of the G.E.C. (Wembley) to the Royal Society of Arts. The objective was to manufacture perfect crystals of sapphire of adequate size. The essential point about the product was not the retention of the outward shape of the crystal, but that the structure of the molecules within should be as near perfection as possible. These experiments were successful and a British and later an American industry of considerable size was established as the result. Sapphires are also produced synthetically in Russia. Mr. Rooksby has said that no synthesis of sapphire had been attempted before 1939, but the need for sufficient jewel bearings during the war caused the Ministry of Aircraft Production to ask that manufacture should be established here, and the G.E.C. set out to rediscover the technical process of sapphire production based on Verneuil's original paper. With all Continental technical information cut off, there were many difficulties to be overcome. Complete success was achieved, however, and the British article is as good as anything made on the Continent. "From the scientist's point of view," said Mr. Rooksby, "synthetic sapphires are much to be preferred to natural stones. . . . There is much better uniformity of quality in crystals manufactured under controlled conditions."

We shall not attempt to follow Mr. Rooksby through the details which he gave to the Royal Society of Arts concerning the manufacture and use of artificial sapphires. Some brief summary of the method will, however, be of interest. The nature of the raw materials to be used is very important, and in order to obtain alumina of the correct texture and consistency, it was found necessary to fire alum crystals in silica trays in a muffle at 1000°C. for two hours. The charge swells up into a meringue-like cake consisting of γ-alumina, which is then broken down to fine powder by a tumbling process. This powder is then placed in a receptacle, of which the bottom is composed of a 40-mesh sieve, like an inverted pepper-pot. On shaking this by tapping with a hammer, powder is released downwards in a slow and controlled stream. The powder is carried in a stream of oxygen, and the gas-powder mixture flows down a vertical tube to a nozzle. On issuing from this, it meets a stream of hydrogen. An oxy-hydrogen flame is formed through which the powder must fall, and in falling through the flame it becomes heated to fusion temperature.

Verneuil's original method was based on building up the crystal from a single small nucleus and so arranging matters that no fresh nuclei could be formed. The finely-powdered alumina prepared as described was thus dropped through the flame on to a refractory support rod held between refractory walls, the powder being directed by the flame on to this rod. As the powder built up at the tip of the rod, the

flame temperature was increased (by varying the proportions of oxygen and hydrogen) to allow the deposit to spread out somewhat. Ultimately, a sort of cylinder began to form, the single crystal being thus built up very slowly by feeding the powder in small increments which are individually melted and merged with the parent crystal. Thus a succession of very thin layers are built on to the crystal. Only the top is molten in the furnace and with each increment of powder from the canister the underlying thin layer solidifies and assumes the structure and crystallographic orientation of the sapphire crystal beneath.

This ingenious method involves very slow growth. There must be sufficient time for fusion to occur and for a general merging with the underlying material to take place before the next increment can be permitted to arrive. The rate of growth cannot be accelerated beyond a certain point without spoiling the crystal structure. This maximum rate of growth is about 15 grams an hour. The rediscovery of the technology of Verneuil's process reflects the greatest credit on all concerned. We might venture to hope that the same team will now tackle the manufacture of synthetic diamonds. Art and nature have been once more allied, and the result is that not only can industrial sapphires be produced, but also sapphires that can be used as gems. Science marches on; but something of romance will have gone out of life when we can grow in the laboratory any gem we like and of almost any size we like.

NOTES AND COMMENTS

A Ministry of Science—Again!

ONCE again the suggestion has been put forward that a Department of Science should be formed, this time in America, where Mr. F. J. Curtis, chairman of the American Section of the S.C.I., recently presented the case for its establishment to the Canadian Section of the Society. We do not propose to reiterate the arguments we have often put forward against such a plan; happily in his country there seems little likelihood of its consideration, even with a Government so prone to control as are our present masters. Neither do we propose to print the arguments adduced by Mr. Curtis; they may be looked up in the issue of *Chem. Eng. News* for July 25, and we do not believe that our readers will find anything specially new or illuminating in them. We are, however, surprised to see that most valuable journal advocating the creation of a new post with Cabinet rank, in short, a Secretary of Science. It points out, somewhat naively, we feel, that the function of a Department of Science should be the furthering of science, not its control and regulation. In the name of Faraday, Liebig, and Willard Gibbs, are there no scientists in America who are capable of " furthering " their profession as much as is required? We refuse to believe it. American scientists are second to none in all departments of their profession, and we are confident that they are fully capable of regulating their business in friendly liaison with Government authorities, in the same way as their counterparts do in this country. British Government spokesmen have made it quite clear that they are generally satisfied with the present organisation of science in this country, and we have no information to the effect that scientific industry is in any way behindhand on the other side of the Atlantic.

Research Students

WRITING from the Cavendish Laboratory to *The Times*, Sir Lawrence Bragg gives encouraging figures of the number of scientific research students at Cambridge, the pre-war average of 140 having risen in the present session to 220; while in the future, it appears, this number is likely to be considerably greater. The figures quoted include the research students in the departments of physics, chemistry, and allied subjects such as metallurgy, biochemistry, and colloid science. This puts a rather different complexion on the regret expressed in the Barlow Report " that neither of the ancient universities has found it possible to suggest any permanent expansion in the student body." As Sir Lawrence Bragg points out, these research students form only a small part of the aggregate student body; but it is from this restricted field that are drawn the scientists who will lead the way in the research work of the future. The problem of scientific man-power is an important one —indeed it is among the most urgent of the day—and it is encouraging to be able to

report, on such unimpeachable authority, that Cambridge University, at any rate, is playing its full part in providing the requisite material, and this in spite of serious difficulties of staffing and accommodation.

Utilisation of Waste Products

AN interesting instance of the discovery of real value in an apparently useless waste product is recorded in a recent issue of the *Journal of the Franklin Institute*. The U.S. Department of Agriculture was seeking a useful outlet for the meal that is left over as a residue after the extraction of the oil from soya beans; and it was decided to experiment with this meal as an extender for the phenolic resin glues employed in the manufacture of plywood. First results were encouraging, but it was resolved to test the glue to see whether it would stand up to the most trying atmospheric conditions. Accordingly, at the Northern Regional Research Laboratory, Peoria, Illinois, an "accelerating weather chamber" was devised, in which the plywood, glued with the phenol-plus-soya glue, was subjected to rain and heat tests far more exacting that it was likely to meet with if exposed to normal climate. Tests up to 750 hours, embodying 375 violent changes from torrential rain to more-than-tropical sunshine, were engaged, and where panels failed under test it was because the "weather conditions" destroyed the wood, not the glue. In the most satisfactory compounding, soya meal was substituted for one-third of the more expensive phenolic resins in the glue. It is to be noted that a local plywood firm, which co-operated in the experiments, was so impressed by the results that it is now using soya meal as an extender in all its phenolic resin gluing operations.

Boilerhouse Economy

THE latest in the series of Fuel Efficiency Bulletins issued by the Ministry of Fuel and Power is entitled *The Installation and Maintenance of Boilerhouse Instruments*. The bulletin describes briefly the different forms of instruments and their function and gives general advice on the positioning of sampling points, setting up of pipe lines and installation and siting of the meters. The instruments fundamentally most important are those which act as eyes to the operator and those which enable heat balances, either partial or complete, to be constructed. The instruments dealt with are limited to feedwater and steam meters, means for fuel measuring, draught gauges, temperature measuring devices, and CO_2 indicators and recorders. The importance of following the makers' operating and maintenance instructions is stressed, particularly because in a short bulletin the very wide variety of instruments could not be covered adequately. It is believed, however, that by following the general recommendations contained in the text by far the greatest of the difficulties popularly associated with instruments will be overcome. We therefore strongly advise industrial boiler-plant users to study the bulletin, an important feature of which is that it contains a great deal of information that will be needed by those who use the boiler house log sheets that are soon to be issued by the British Standards Institution.

Discouraging the Midge

SCOTTISH manufacturing chemists indicate that there has been only a limited demand for D.M.P. midge-repellent creams of the type devised by the Scottish Tourist Board. This has been largely due to the cool conditions which have applied throughout the year. Continued experiment is, however, being made in Scotland on the habits and prevalence of midges, and the prevention of the midge pest for the correction of which the D.M.P. lotion and creams were provided. A Midge Sub-Committee of the Department of Health for Scotland has been formed to carry out detailed investigations with the aim of eliminating the pest at its source. Such detailed research appears not to have been previously undertaken, and little is known of the breeding grounds or habits of the 20 varieties of midge which are general in Britain. As soon as a midge bites, it is being trapped for identification and inspection, in a specially devised pipe. When sufficient information has been accumulated by the four university men now engaged on this work, a policy of mass prevention will be adopted to discourage the breeding and development of the pests.

According to latest reports from France, many industries have made great progress in July, thanks to the largely increased coal imports. Certain chemical products, including acetylene and liquid oxygen, now exceed the pre-war output figure by 70 per cent., while potash is up by 20 per cent. on 1939 and aluminium by 45 per cent.

Some Modern Solvents

A Summary of their Properties and Uses

by A. E. WILLIAMS, F.C.S.

WITHIN recent years many new types of solvent have been added to the already long list of those employed in industry, while other types are improvements on, or slight modifications of, well-established products. As a result of the now much wider range of varnishes, lacquers, etc., being manufactured, following upon the use of numerous synthetic resins in these products, modern solvents have found widespread employment in this sphere as well as in the textile and other industries. Most solvents can be classified as hydrocarbons—alcohols, ethers, esters, aldehydes, or ketones; the majority having as their origin either coal or petroleum. Many result from the development of the Fischer-Tropsch catalytic processes; while others are formed by hydrogenation and other methods operating on petroleum derivatives. Until the development of these processes and methods on a large industrial scale, with concomitant lowering in price of the products, the latter were obtained by the older fermentation processes. The production of solvents from acetylene is carried on extensively in districts wherein cheap electricity is available for carbide manufacture. When subjected to catalytic processes acetylene is capable of producing such solvents as ethyl alcohol, *n*-butyl alcohol, ethyl acetate, acetone, acetaldehyde, acetic acid, acetaldol, and crotonaldehyde. In some instances one solvent may be produced from another by simple chemical reactions. There are cases in which a specific substance may not be soluble in either of two particular solvents when the latter are used separately, but if the substance is acted on by a mixture of the two solvents it is readily dissolved. For example, cellulose nitrate is not appreciably soluble in either alcohol or ether, but a mixture of these two solvents dissolves it. In a similar manner, neither aliphatic higher alcohols nor aromatic ethers will dissolve nitrocellulose when acting alone, but in admixture powerful solvents are obtained for nitrocellulose.

Typical of the range of modern solvents now available in this country are those given in the following table, which is reproduced by permission of Howards & Sons, Ltd., Ilford, the manufacturers of the solvents.

Solvent	*Trade Name*	*Boiling Range, °C.*	*Flash Point, °F.*	*Specific Gravity*	*Viscosity at 25° C. Centipoises*
Cyclohexane		80.5–82 (95%)	36.5	0.782	0.936
Ethyl lactate		145–160 (95%)	125	1.040	2.620
Cyclohexanone	Sextone	150–158 (95%)	117	0.950	2.200
Cyclohexanol		158–163	153	0.947	4.600
Diacetone alcohol		160–170 (92%)	130	0.943	2.907
Methylcyclohexanone	Sextone B	160–175	130	0.920	1.707
Methylcyclohexanol	Sextol	165–180	156	0.920	28.140
Cyclohexanol acetate		170–177	139	0.960	2.310
Methylcyclohexanol acetate	Sextate	172–192	143	0.942	2.360
Dipentene		175–195	140	0.850–0.860	1.540

Cyclohexane

When cyclohexanol is heated at 420°-440°C. with hydrogen under pressure, in the presence of aluminium chloride, a mixture of cyclohexane and normal hexane results. Various methods are in use for the commercial production of cyclohexane from benzene by hydrogenation. The catalyst which appears to be chiefly used is nickel, although copper has also been employed. Benzene may be quantitatively hydrogenated to cyclohexane by using an 8 per cent. nickel catalyst and a temperature of 250°C. Cyclohexane is recommended for general use in the fine chemical industry, specifically for recrystallisation purposes, for which its sharp boiling point, pleasant odour, and attractive price make it an ideal solvent. The odour of this solvent may be very easily

masked by chemicals which are recrystallised from it and by essential oils which are extracted by it. In this respect cyclohexane offers great advantages over the special petrol fractions which have hitherto been used for this purpose. This solvent is miscible in all proportions with other inorganic solvents, it is non-toxic and does not attack metals. Its rate of evaporation is approximately the same as that of benzene and it may be distilled without decomposition. Cyclohexane is less soluble in water than is petrol, also the solubility of water in this solvent is less than it is in petrol. It is an excellent solvent for oils, fats, and waxes, and it will dissolve 9 per cent. of its volume of carnauba wax, or over 20 per cent. of its volume of paraffin wax, without precipitation. As a solvent for crude rubber it is efficient, 15 per cent. solutions of pale crêpe being obtained in the cold.

Ethyl Lactate

Lactic acid is still mainly prepared by fermentation processes and, as the yield by such methods is relatively high, often 90 per cent. of the theoretical, there is not much incentive to replace these processes by other methods. From lactic acid numerous lactates are produced, some of which are used as plasticisers for cellulose derivatives and some as solvents. Ethyl lactate may be produced by passing dry HCl into a solution of lactic acid containing ethyl alcohol, allowing to stand for 24 hours, eliminating the excess hydrochloric acid, and then distilling under reduced pressure. Ethyl lactate is completely miscible with water, lacquer solvents, and diluents, including white spirit, and all other organic solvents except high-boiling petroleum hydrocarbons. It is non-inflammable, non-explosive, and non-toxic and is extremely difficult to hydrolyse with either hot or cold water.

As a solvent for nitrocellulose, cellulose acetate, and cellulose ethers it is much in demand, a 25 per cent. solution of benzylcellulose being readily prepared in the cold. Both natural and synthetic resins—*e.g.*, shellac, copals, phenols, glyptals, urea-formaldehyde, vinyls—are readily dissolved by it, and it is one of the best solvents for the basic dyes used in lacquers. This solvent has a dilution ratio of 6.25 with respect to toluene and 5.75 to xylene. Such ratios can be used in practice, since ethyl lactate evaporates much more slowly than either of these diluents, so that the dilution ratios are not upset in the drying lacquer films. A mixture of 1 part ethyl lactate with 4 parts high-flash naphtha is very useful for high-flash nitrocellulose lacquers. Ethyl lactate is very stable even in the presence of alkaline pigments, etc., and of resins and oils of high acidity, provided that moisture is not present to any appreciable extent. Lacquers containing this solvent and alkaline pigments have been stored in tins for over 8 months without deterioration or hydrolysis. Ethyl lactate finds extensive employment in the preparation of synthetic resin lacquers, both of the air-drying and stoving types, thanks to its high solvent power for many of these resins, the low viscosity of the solutions obtained and its suitable evaporation rate.

The range of solvents for cellulose acetate is comparatively small, while the majority of them have the disadvantages of being very inflammable or toxic, and they are nearly all of the "low-boiler" type. Hence, as solvents for cellulose acetate, such products as cyclohexanone, diacetone alcohol, and ethyl lactate have big advantages, for they possess suitably graded evaporation rates, they prevent the too rapid drying of a film, and in this way avoid the dangers of blushing and uneven flow. The dilution ratios of ethyl lactate with cellulose acetate are considerably higher than those of any other solvent. In the manufacture of fast coating colour finishes for leather, ethyl lactate is used extensively, and it is widely employed in the manufacture of leathercloth, artificial leathers, and special types of linoleum. In this direction ethyl lactate gives excellent flowing out and penetration, the films so formed having good polishing surfaces and adhesion. This solvent has been found useful in the preparation of cellulose acetate and ether powder mouldings and plastics, and also the celluloid types. It is used in French polishes, wherein it is effective in preventing "chilling." The textile industries employ it in printing with indigosols, basic, acid, direct, and chrome colours, as a solvent for the dye, and for relustring acetate rayon. Because of its high solvent power for resin, oils and other ingredients of printing inks—and the fact that it is entirely water-free—it is used in the printing industry for the cleaning of type, blocks, offset blankets, rollers, and other delicate printing equipment.

Cyclohexanone

Cyclohexanone is obtained in admixture with cyclohexanol by the hydrogenation, under pressure, of aromatic hydrocarbons in the presence of nickel or copper catalysts. The raw materials used may be phenol, toluene, or xylene, while the temperatures employed may range between 140° and 200° C. It is a colourless liquid with a ketonic odour, its solubility in water being about 5 per cent. The anhydrous solvent distils without decomposition and can be steam-distilled quantitatively from all its mixtures. With most lacquer solvents and other organic solvents it is miscible, while it does not attack metals, is non-inflammable and non-toxic. For nitrocellulose it is a good solvent, and in nitrocellulose lacquers it is used as a solvent of

the " medium-boiler " type, this term referring to relative rate of evaporation. Cyclohexanone is an excellent solvent for cellulose acetate, and when used as a solvent for cellulose ethers gives low viscosity solutions, dissolving from two to three times as much as most other solvents.

In the varnish industry and in others wherein a powerful solvent for resins—both natural and synthetic—is required, it is largely used for shellac, copals, ester gum, coumarone, phenol- and urea-formaldehyde resins, glyptals, polystyrenes, polyvinyls, cyclohexanone resin, maleic resins, and the like. In the preparation of spraying, brushing, and dipping lacquers it finds wide employment. Its rate of evaporation produces lacquers having good flow, and it gives clear, smooth, glossy, tough, and strongly adhesive films. Lacquers containing it have strong blush resistance, which renders unnecessary the addition of any other anti-blush material, such as butyl alcohol or high-boiling esters. When used in a spraying lacquer its normal evaporation rate can be considerably increased by the addition of low-boiling diluents, since it has a very high dilution ratio for coal-tar hydrocarbons.

High Dilution Ratio

To toluene and xylene it has a dilution ratio of 7.25 and to benzene 6.25, higher than those of any other lacquer solvent. Such ratios are quite workable in practice because cyclohexanone evaporates much more slowly than these diluents or their mixtures, so that the dilution ratios are not upset in the drying lacquer films. This combination of high solvent power with high dilution ratio enables a considerably higher percentage of nitrocellulose to be kept in a lacquer than when weaker solvents are used. In the blending of nitrocellulose and resins in lacquers cyclohexanone is specially effective, requiring no further addition of any other resin solvent. A special feature of this solvent is that it is applicable to both spirit-soluble and hydrocarbon-soluble resins, as also to the preparation of " combination " lacquers containing nitrocellulose and such oils as linseed and tung.

In the creation of light and fancy leathers, leather coats and gloves, cyclohexanone is considered by the industry to be one of the best thinners for the fast coating colour finishes used therein. It is used as a direct solvent of the " medium-boiler " type in cellulose acetate lacquers and dopes, for which purpose it imparts similar properties to the films and has otherwise the same advantages as ethyl lactate. Because of its special evaporation rate and capacity for dissolving nitrocellulose and oils it is used extensively in the manufacture of leather cloth, artificial leathers, and some types of linoleum. In a variety of industries this solvent is much in demand for the degreasing of metals, wherein it has the advantage of being non-inflammable, non-toxic, and non-corrosive. Thanks to its high solvent power for shellac, cellulose esters, and basic dyes, cyclohexanone is used in the preparation of printing and marking inks. At slightly elevated temperatures, such as 50°C., it is a good solvent for crude rubber, and at this temperature 20 per cent. solutions of pale crêpe can be obtained within a few hours; while it also produces cellulose lacquers having excellent adhesion to rubber surfaces.

Cyclohexanol and Methylcyclohexanol

Cyclohexanol, or hexahydrophenol, results from the hydrogenation of pure phenol. Methylcyclohexanol is a product of the hydrogenation of the various cresols, using nickel as a catalyst, and temperatures between 180° and 220°C. Both cyclohexanol and its methyl derivative are particularly suitable for incorporation in soaps and preparations of the sulphonated-oil, hydrocarbon, and fatty-alcohol types, for several reasons. In the first place they have remarkable solvent, wetting-out and emulsion-stabilising properties. Secondly, they are high-boiling, non-inflammable and non-toxic alcohols, which are very stable and, therefore, cause neither corrosion of plant or containers, nor decomposition of soaps. Finally, they are easily incorporated in soaps of all kinds, producing soaps giving clear solutions with water. Soaps containing either of these solvents have greater detergent powers and higher solubilities than soaps not containing such solvents. The Rideal-Walker coefficient of methylcyclohexanol is 1.5, and soaps in which it is incorporated possess marked insecticidal and germicidal properties without being toxic. Both in this country and abroad these two solvents are now widely employed in the manufacture of all types of soap.

They are also good solvents for several classes of dye, such as basic, chrome, some acid, and the majority of the acetate rayon dyes. In many printing and dyeing operations wherein the above classes of dye are involved, they are widely used, because of their high solvent, dispersing, and penetrating powers, good stability, and suitable volatility. They are of assistance in penetration with vat colours. Although they are not direct solvents for nitrocellulose, in the presence of esters or ketones they form good solvent mixtures for it, while at fairly high temperatures they have a softening action on it. Neither of these solvents has any action on cellulose acetate at ordinary temperatures, but they have a slight gelling action on it at temperatures between 90° and 100°C., and a somewhat stronger action between 100° and 110°C. Both of them are good solvents for cellulose ethers, and in nitrocellulose lacquers they are employed as

"high-boiling" alcohols, retarding evaporation and preventing blushing, for which purpose they are most effective, but care should be taken that they are not used when only "low-boiling" solvents are present. In synthetic resin lacquers of the stoving type both these solvents find employment because of their high solvent powers for synthetic resins and their suitable evaporation rates.

To reduce the viscosity of oil varnishes a small percentage of methylcyclohexanol may be used, particularly with very quick-drying wood oil varnishes, resulting in appreciable economy in thinners. It reduces "false body," giving complete and homogeneous solutions and, even when after running, the copals are not compatible with the polymerised wood oil—as sometimes happens—the addition of methylcyclohexanol will clarify the varnish. The same applies to wood oil and copal esters. To prevent skinning in both oil- and synthetic-resin varnishes the addition of a small proportion of methylcyclohexanol is most effective; and for this purpose, in general, it is better—as well as cheaper—than some other solvents. Methylcyclohexanol is used in the form of a liquid soap—containing a fairly high percentage of the solvent—for cleaning all types of paint work. This solvent is also employed in degreasing leather, either in the dry solvent degreasing process—in which it is mixed with the petrol, etc., or in the aqueous soap degreasing process, wherein it is used either dissolved in the soap solution or in the form of a methylcyclohexanol soap. These two solvents find employment in the preparation of boot, furniture, and metal polishes, because of their high solvent power for waxes and stabilising power for wax emulsions, combined with a strong detergent action. They are used for the production of homogeneous liquid mixtures of hydrocarbons and alcohols or ketones. Cyclohexanol has been proved successful in preventing oxidation in lubricating oils and in increasing the oiliness of oils for high-pressure, low-speed bearings.

Diacetone Alcohol

This alcohol is one of the many derivatives now obtainable from petroleum, by way of propylene and acetone. Diacetone alcohol is miscible in all proportions with water, the usual lacquer solvents, and all other organic solvents except white spirit—with which it is only partially miscible—and high-boiling petroleum hydrocarbons, in which it is entirely immiscible. Alkalis decompose it at room temperatures and acids decompose it at temperatures above 100°C. It is an excellent solvent for nitrocellulose, with a solvent action slightly quicker than that of methylcyclohexanol acetate, while it is a fairly good solvent for cellulose acetate and cellulose ethers. This alcohol is used as a solvent of the high-boiler type in nitrocellulose lacquers, and it is useful for the formulation of brushing lacquers, since its rate of evaporation is low, so that it allows ample time for brushing without unduly delaying the drying of the lacquer. It has a dilution ratio of 3.25 with respect to toluene, 2.75 to benzene, and 2.0 to xylene.

In synthetic resin lacquers of the stoving type diacetone alcohol is used because of its suitable evaporation rate combined with its high solvent power, specifically for the urea resins. It is used as a direct solvent of the high-boiler type in cellulose acetate lacquers and dopes, and in the preparation of acetate film. Its dilution ratios with cellulose acetate are higher than those of any other solvent except ethyl lactate. In the textile trades diacetone alcohol is used in printing with basic, acid, chrome, and direct colours, as a solvent for the dye. In printing-inks it is widely employed, and owing to its very high solvent power for shellac and dyes it is used in spirit and watergravure inks, while its evaporation rate makes it useful as a high-boiling solvent for cellulose inks. This alcohol is a good solvent for bitumen, but it has no action on rubber.

Methylcyclohexanone

Obtained by the methylation of cyclohexanone, this product is a good solvent for cellulose ethers, nitrocellulose, gums, and resins, including synthetic products like polyvinyl chloride and polystyrene. Furthermore, the addition of a small percentage to other solvents will markedly accelerate solution of nitrocellulose and resins. It is used as a solvent of the medium-boiler type in nitrocellulose lacquers, and it has excellent solvent power for basic dyes, wherein its good wetting properties appreciably aid solution. The dilution ratios of methylcyclohexanone are 5.5 to toluene and benzene, 7.0 to xylene, and 1.25 to white spirit or turpentine substitute. Even higher dilution ratios are obtained with toluol-methylated-spirit mixtures, a dilution of 12 volumes with an equal-parts mixture having been obtained, having a final concentration of 10 per cent. nitrocellulose. Methylcyclohexanone is much cheaper than cyclohexanone, but both these solvents have the property of enabling a higher gloss to be obtained in films laid down from them than is attainable with any other solvent. Incidentally, they are the only solvents which will blend nitrocellulose and coumarone or indene resins in lacquers.

Methylcyclohexanone is used in cellulose acetate lacquers and dopes as a high-boiling solvent for preventing blushing, also as a high-boiler in all types of spirit varnish, wherein it improves flow and brushing properties, on account of its efficiency as a gum solvent. It is likewise employed with plastics and moulding-powders of the cellulose ester and ether and synthetic resin types.

A small percentage is sufficient to reduce the viscosity of oil varnishes, which makes for great economy in thinners, especially in the case of very quick-drying wood oil varnishes. In common with cyclohexanone, it is a good solvent for bitumen, and in bituminous compositions; in those containing cellulose esters, ethers, or oils, it is extensively used to reduce the viscosity and to give better flow, brushing, and gloss. Its solvent power for crude rubber is somewhat lower than that of cyclohexanone, but it is an excellent solvent for chlorinated rubber, and is normally used in small proportions in conjunction with the cheaper hydrocarbons. This solvent tolerates the addition of far greater quantities of white spirit to chlorinated rubber solutions than does any other solvent. For example, a mixture of 1 part methylcyclohexanone by volume and 6 parts white spirit will give a 10 per cent. solution of extra high viscosity chlorinated rubber.

Cyclohexanol Acetate

Cyclohexanol acetate is miscible in all proportions with the usual lacquer solvents, diluents, etc., is insoluble in water, and distils without decomposition. While it is a good solvent for nitrocellulose it is a little slower in action in this connecton than is cyclohexanone. Its rate of evaporation resembles that of ethyl lactate. It is a powerful solvent for many resins—both natural and synthetic—including dammar, copals, ester gums, urea-formaldehyde, glyptals, polyvinyls, polystyrene, cyclohexanone resin, maleic resins, etc. As a solvent of the medium-boiler type it is used in nitrocellulose lacquers, and it is employed both in spraying and in brushing lacquers, wherein it produces good blush resistance, excellent flow, and films having a high gloss. With toluene it has a dilution ratio of 2.5, the figures for xylene and white spirit being 3.0 and 1.5 respectively. Its high flash-point is a decided asset in many compositions, while its efficient blending power, combined with suitable evaporation rate, makes it one of the most useful solvents for preventing and removing "gum blush." Cyclohexanol acetate is a suitable solvent for blending nitrocellulose, linseed- and tung-oils in combination lacquers. It is also a good solvent for fats, oils (fixed, mineral, and essential), and waxes.

Solvent for Waxes

A typical example of its solvent power for waxes is shown by the fact that it completely dissolves 12 per cent. of its volume of carnauba wax without precipitation. It is a tolerably good solvent for bitumen, but in this respect cyclohexanone and methylcyclohexanone are better. The solvent action of cyclohexanol acetate on crude rubber is considerably quicker than that of cyclohexanone. In the cold, rubber is dissolved only slowly, but the action is greatly accelerated on heating to about 50° C., and at this temperature 20 per cent. solutions of pale crêpe are obtained in a few hours. In the rubber industry this solvent has an advantage over many others used in that it is both non-inflammable and non-toxic.

Methylcyclohexanone Acetate

This solvent may be a mixture of the three isomeric acetates. It is insoluble in water, distils without decomposition, is miscible in all proportions with the usual lacquer solvents and diluents, and also with all other organic solvents. It is non-inflammable, non-explosive, non-toxic and, in general, is used in the same industries as cyclohexanol acetate. Its solvent action on rubber is slightly slower than that of cyclohexanol acetate. This solvent gives smooth, homogeneous, glossy films when used in spraying and brushing lacquers, and produces products with a high resistance to blushing under very humid conditions. It is a very effective solvent for blending nitrocellulose and resins, and also for blending nitrocellulose with linseed- and tung-oils in combination lacquers, while it is also used in synthetic resin lacquers of the stoving type. It has a dilution ratio of 2.25 with respect to toluene and xylene, 2.0 to benzene, and the comparatively high ratio of 1.5 with white spirit. Its solvent power for oils, fats, and waxes, and for bitumen, is excellent.

Dipentene

Dipentene may be obtained from various natural sources; it may also be prepared from pinene or camphene, or by heating terpineol with potassium hydrogen sulphate. It is a solvent which can usefully replace turpentine or white spirit in all types of oil varnishes and synthetic resin finishes, in which its solvent properties ensure good flow and prevention of skinning. For chlorinated rubber it is useful as its mild solvent action does not cause lifting of the undercoat. It finds extensive employment in the manufacture of wax floor and furniture polishes, replacing turpentine or white spirit. As an anti-frothing agent it is used in textile printing and, partly on account of its pleasant odour, it is widely utilised in disinfectant preparations.

The growing need for reliable and economical pumps in the chemical industry brings many interesting and often difficult problems with it, chief of which is the employment of materials which are not attacked by the liquids delivered. Some of the solutions found for such problems by Sulzer Bros. (London), Ltd., 31 Bedford Square, London, W.C.1, are described in No. 3 of *Sulzer Technical Review*.

LETTER TO THE EDITOR

B.A.C. and T.U.C.

SIR,—I have read your "Notes and Comments" on the ballot which the British Association of Chemists is taking on the question of affiliation with the T.U.C., and I feel that in some ways it tends to mislead anyone not familiar with the private discussions that have taken place inside the Association. It would certainly mislead some who may be considering joining the British Association of Chemists.

In the first place I think it should be made clear to your readers that the resolution upon which members were asked to vote was *not* the Council's motion. During the last few years there has been so much argument among members for and against affiliation to the T.U.C. that the Council decided that the matter ought to be settled one way or the other as quickly as possible. They decided to consult the members by calling a general meeting and by taking a ballot, and the Executive Committee were instructed to proceed with the arrangements.

One of the members of the Executive Committee, Mr. D. Jackson, happened to be a strong supporter of affiliation, and he was asked to propose the resolution in favour of affiliation at the general meeting. I happened to be in the chair at the general meeting and I made it clear that Mr. Jackson would not speak on behalf of the Executive Committee, but would express his own opinion. Those were my words. The Council are under no delusions regarding the political activities of the T.U.C., but they realise that there are some reasons why affiliation might be an advantage to some members.

Government Departments like to negotiate with large bodies representing groups of workers or a group of manufacturers. Every day I find that I can negotiate with a department as chairman of a trade association on a matter which they would not discuss officially with a private firm. Similarly, some of the larger firms in the chemical industry like to negotiate with employees who are properly regimented in unions and affiliations of unions, and in this way they compel bodies like the B.A.C. to consider how far they should go in this direction in their efforts to help all their members.

My own view is that affiliation need have none of the ill effects which you visualise, but at the same time I believe that it would label the Association as a supporter of a certain political party. That, I believe, to be very bad indeed, not because it would be true, but because it would prevent large numbers of chemists from joining the B.A.C.

A very strong association along the lines of the B.A.C. is needed. All chemists should be members whether they are employees or managing directors of companies, professors of chemistry, or teachers in schools. There are many reasons why this is becoming increasingly necessary, and the State schemes of social security add to the urgent need for co-operative effort to maintain and improve the position of professional men.

Many trade unionists are not socialists, and in theory it is possible for the T.U.C. to be run by members of the Conservative and Liberal parties. If chemists wish to belong to a trade union which is definitely a supporter of the Socialist party they can probably find one which they can join, but it is not the B.A.C. We have among our members active representatives of all parties and we plan to build an organisation which can benefit the profession as a whole and not a particular section who work for political ends.—Your faithfully,

NORMAN SHELDON,
Vice-President & Vice-Chairman of Council of the British Association of Chemists.

London, W.1.
August 19.

Fluorene and Fluoranthene

A Simple Synthesis

PASSAGE of 2-methylbiphenyl in the vapour phase at 500°C. over a palladium catalyst results in its conversion to fluorene. The conversion can be made nearly quantitative by recycling the unchanged starting material, and this reaction provides a simple, new method of obtaining synthetic fluorene.

In the synthesis of fluoranthene by means of the "cyclodehydrogenation reaction" starting material is obtained from the Grignard condensation of 1-naphthylmagnesium bromide with cyclohexanone. The carbinol which results from this reaction is dehydrated to 1-(tetrahydrophenyl)-naphthalene. When this compound was treated with a palladium catalyst at 500°C. it was converted to fluoranthene. A catalyst composed of 12 per cent. chromia on alumina is better than palladium in the reaction.

It is of interest to note that fluorene and fluoranthene occur in large quantities in the tar from coal carbonisation. The cyclodehydrogenation reaction not only helps to explain the occurrence of many polynuclear compounds in coal tar, but opens up new methods for obtaining in a simple fashion various pure synthetic polynuclear compounds. (From a paper by Orchin and Reggel before the American Chemical Society; from *Chem. Met. Eng.*, 1946, *53*, No. 7, p. 264).

New Foamslag Slab Factory

Glasgow Corporation's Experiment

A FOAMSLAG slab precasting plant was opened at Tollcross, Glasgow, on August 9, under the auspices of the Glasgow Corporation. The project was planned in 1939, when the research department of the Glasgow Housing Department became interested in the possibilities of precasting foamslag slabs for building. Following various experiments full approval was given to the project, although actual authority to build did not mature till August, 1944.

Foamslag is a cellular lightweight aggregate produced by the combined treatment of inflating and chilling molten blast furnace slag, of suitable chemical composition, at a temperature of approximately 1400° C. The raw material is treated with water by a patented apparatus and the molten slag inflated or "foamed" to from seven to ten times its original volume. The cells so formed are sealed or self-contained and when the slag is cast the same characteristics apply, the sealed pores remaining inert and not decomposing. This makes foamslag a suitable material for housing; it dries quickly, is incombustible, and is chemically identical with granulated slag, which forms the basis of Portland blast-furnace cement. It is light in weight in relation to its bulk, has excellent insulating qualities, and is also useful in that it has nailholding qualities to an extent not possessed by other such materials.

Design and Lay-Out

This factory is probably the only direct-flow precast foamslag slab plant in this country and has been specially designed to meet the requirements of Glasgow Corporation. It consists of a single-storey building 270 ft. long by 170 ft. wide with a floor space of 30,000 sq. ft. It has two identical units separated by a central line, the only common facility being the boiler house. A second storey in the rear of the building carries the mixing plant.

The plant being in duplicate, the following details cover one half-section, an exact replica completing the whole. The dominating feature of the plant is the elevating gear at the side. This consists of a boom scraper which operates with a semicircular movement, dragging aggregate from the storage bins (in the open) to a hopper, from which they are elevated (still externally) in a bucket elevator to a point above the mixing plant. The material is fed by gravity into storage hoppers, which retain the aggregate under control until required. Cement is meanwhile brought in from a store in the rear of the plant, carried on an overhead runway by cradle to a loading bank, and tipped into a floor hopper, through which a worm operates to carry the cement to a shaft. A bucket elevator working in this shaft carries the cement to a storage point above the mixers. Water is stored in a 10,000-gallon storage tank behind the plant.

Description of Process

All the ingredients are controlled at the mixing point by careful gearing of the delivery feeds to the pace of the mixer belt. The mixer is a special type A.B.C. automatic belt controlled with a maximum capacity of 30 cu. yds. per hour. Delivery feeds can be adjusted to give the precise volume required, while the stoppage of any one delivery would automatically halt the entire process. It is thus impossible for the mixer to fail to deliver an incorrect mix after the controls have been set to a given constitution of mix. The mix when processed is fed to the moulds on the ground floor. These moulds consist of steel frames with steel mesh and specially designed locking clips. Reinforcement, spot welded on the premises, is inserted before pouring, one moulding bay being used entirely for wall slabs. The largest of these is 10 ft. by 8 ft. 8 in. by 6 in. thick. The other bay, in the adjoining section, is used for wall angles, etc.

Moulds and slabs, etc., are moved, throughout the entire plant, by a system of overhead runways and travelling cranes. At the milling point the moulds are lowered on to a floor roller conveyor section for easy and steady handling, and then hoisted by pendant chains. Automatic stops and locking gear ensure the correct alignment of the hand overhead transporter cranes with the hand runways, the whole offering a smooth easy system of transport to any point in the plant.

Moulds are taken to a battery of eight curing ovens, lying centrally throughout the plant, four to each mixing and filling unit. Internal walls are of foamslag slabs and doors are steel, specially sealed. Each oven will carry about 30-40 slabs, which are processed by wet and dry steam at about 130 lb./sq. in. pressure for 24 hours before emerging adequately cooked. The wet steam is carried in a central floor-duct with outlets at 4 ft. 6 in. centres, while the dry heat is provided by a bank of pipes on one wall of each oven. On emerging, the slabs in their moulds are transferred to the dismantling section. Here, at the delivery end of the plant, the steel moulds are lowered, and the clips undone; the slab is then secured and carried out of its mould to the storage racks. The mould is reassembled

and transported back to the filling point for further use.

The storage racks, partly in the open, consist of a series of steel racks against which the slabs are either rested or clipped. Loading bays among the racks facilitate easy handling of the slabs for loading, the work being done entirely by mechanical means. In the transport from the storage yard to the site, similar special plans have had to be made. A low trailer with twin steel racks has been devised to carry eight slabs, which are loaded in a semi-erect position and clipped to the racks by specially designed clips.

The plant has welding shops for the prefabrication of the reinforced rod and additional storage accommodation for the accumulation of slag aggregate. The entire layout is mechanically excellent, much of the equipment and components in use having been designed specially for the plant. It follows the smoothest possible theory of straight flow operation, and should achieve the desired output, stated a year ago to be an annual capacity of 2000 houses. So far the plant has been delayed by lack of materials and by other difficulties, and its 1946 output has yet to be determined. Cost of construction is not indicated, and estimates vary from £30,000 to £150,000. The mechanical handling facilities and directness of operation may well be envied by older plants where conditions and space prevent the adoption of such straightforward methods.

Oilseed Production

Mission to West Africa

TO investigate and report, in conjunction with the Colonial Governments concerned, the possibilities of increasing an exportable surplus of vegetable oils and oilseeds, and to recommend means of securing maximum production, including transport facilities—these are the terms of reference of the mission which the Colonial Secretary, Mr. George Hall, has decided to send to West Africa.

Chairman of the mission is Dr. B. A. Keen, D.Sc., F.R.S., assistant director of Rothamsted Experimental Station; the members are Mr. J. McFadyen, director of the English and Scottish Joint Co-operative Wholesale Societies, and Mr. C. E. Rooke, C.M.G., formerly general manager of the Nigerian Railways. They left by air for Nigeria on August 19. That colony is the immediate field of investigation, and the question of visiting other West African territories will be decided in the light of information gleaned during the tour, which will cover the groundnut-growing area around Kano, in the North, and the palm nut belt in the eastern province.

Technical Steel Mission

Visits to Caribbean Oilfields

FURTHER news has now been received about what is believed to be the first purely technical mission ever to leave this country. It will shortly make a three-months' tour of the oilfields and refineries in Trinidad, Venezuela, and Colombia (*see* THE CHEMICAL AGE, August 17, p. 209). An invitation to visit the oilfields was extended by one of the petroleum companies to The United Steel Companies, Ltd., who have long been engaged in special research work for the production of steels to resist the many difficult conditions existing in the drilling and refining of petroleum. Further consideration showed that problems other than metallurgical might be encountered during such a visit and convinced the company that the mission would more correctly be made representative of other interested industries. Accordingly, member firms of the Council of British Manufacturers of Petroleum Equipment were approached and their co-operation was readily forthcoming. While all the members of the present mission are members of the Council, the mission is purely a private one organised and financed by the members themselves.

An American Monopoly

It is well known that before the war this valuable business was almost entirely an American monopoly and equipment to the value of many millions of pounds is purchased annually by the oil companies. The importance of the visit, therefore, cannot be too greatly stressed, since its successful conclusion must have far-reaching results on our export trade. Every support is being accorded the mission by the Ministry of Fuel and Power and the Export Development Department of the Board of Trade, and on arrival in Trinidad a public reception will be held by the Governor General. The President of Venezuela has also expressed a wish to receive the members.

Members of the Mission

The mission, as already reported, is under the leadership of Mr. G. R. Bolsover, director and chief metallurgist of Samuel Fox & Co., Ltd. (branch of the United Steel Companies, Ltd.), and comprises the following: Messrs. E. E. Allen (Industrial & Engineering Development Assn.); D. H. Carter (Head Wrightson Processes, Ltd.); A. G. Ellison (Yorkshire Copper Works); E. T. Forestier (Newman, Hender & Co., Ltd.); E. F. E. Howard (Hayward, Tyler & Co., Ltd., also representing other firms); F. Kenyon (Wm. Kenyon & Sons, Ltd.); H. Martin (Murex Welding Processes, Ltd.); E. Pritchard (British Oilfields Equipment Co.); and G. H. Thorne (Dawnays, Ltd.).

Fluorine Production in the U.S.

Opportunity for New Processes

NOTED for its pioneering activities in the development of fluorine chemicals in America, the Pennsylvania Salt Company has again set the pace with its pilot-plant production of pure elemental fluorine. The process employed has been described in *Chem. Met. Eng.* (1946, *53*, No. 7, p. 106), by Richard W. Porter, and an abridgement of his account follows hereunder.

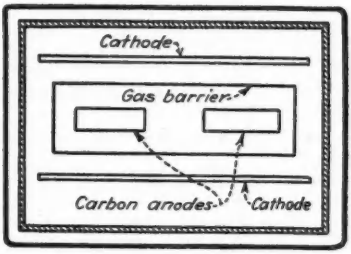
Following their successful production of anhydrous hydrofluoric acid (A.H.F.) in 1931, the company, conveniently known as "Pennsalt," proceeded with experimental methods of manufacturing elemental fluorine, having decided that the electrochemical method was the only practical way in which this element can be produced. Now, after several years, "Pennsalt" has evolved an electrolytic cell which has been operated successfully for some time in the production of high-purity fluorine; and this pilot-plant cell seems to meet the requirements for economic commercial production.

Capable of producing several pounds of fluorine daily, the cell consists essentially of a rectangular jacketed vessel of welded steel (Fig. 1), with an airtight removable cover. From the cover are suspended two anodes of carbon, two steel cathodes, and a steel gas barrier. A standard grade of corrosion-resisting low-carbon steel is used throughout. Carbon is the only satisfactory anode material; nickel anodes suffer excessive corrosion, while graphite disintegrates rapidly.

Anodes and gas barrier are insulated from each other and also from the cathode which is electrically connected to the cell body. The barrier, a sheet steel skirt, surrounds the anodes and extends below the surface of the electrolyte to keep separate the products of electrolysis. Anolyte and catholyte mix freely in the cell, no diaphragm being necessary.

Operating normally at 9-10 volts and 250 amp., the cell can handle a fairly high overload. Current efficiency is well over 90 per cent. However, large electrode overvoltages, as well as electrolytic resistance, reduce the aggregate power efficiency to a low value. The energy requirement calculated for the cell reaction, $2HF \rightarrow H_2 + F_2$, would be equivalent to a theoretical voltage considerably lower than the 9-10 V. observed.

The electrolyte is made up of a solution



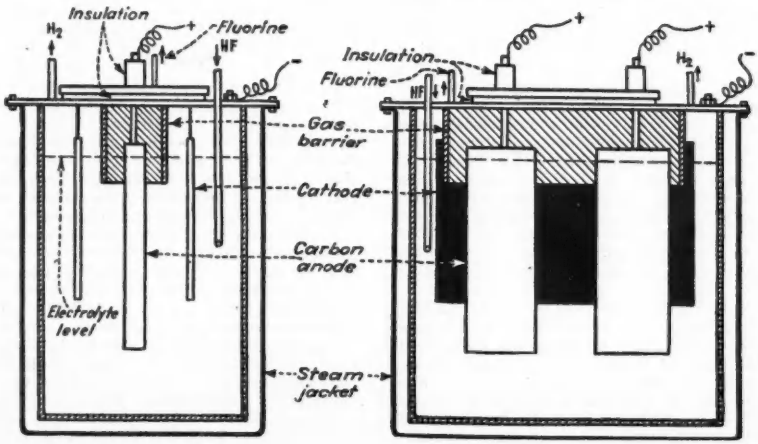


Fig. 1. Schematic diagrams illustrating the "Pennsalt" electrolytic fluorine c ll (*Chem. Met. Eng.*).

of A.H.F. in fused potassium bifluoride with 40 per cent. A.H.F. by weight. Solid KHF_2 charged into the cell is heated to about 95°C. by steam in the cell jacket, but it remains solid until the addition of A.H.F. lowers the melting-point of the mixture. At the concentration used, the m.p. is 72°C.

When electrolysis begins, HF dissociates to form fluorine gas at the anode and hydrogen at the cathode. Kept separate by the barrier, these products are discharged continuously. As the electrolyte is depleted of hydrogen and fluoride ions, it is regenerated, either continuously or intermittently, by addition of A.H.F.

Both the fluorine and hydrogen contain about 5 per cent. by weight of HF and less than 1 per cent. of other impurities. These may be comprised of atmospheric gases and, to a lesser degree, of fluorine oxide formed from traces of moisture which may enter with the HF feed. Carbon tetrafluoride does not seem to be present in any significant quantity. Fluorine is purified by removing the HF either by absorbing it in sodium fluoride or by chilling. After purification the fluorine gas is used directly or is compressed and filled in special cylinders for storing and shipping. For some applications, such as direct fluorination of hydrocarbons, HF is not an objectionable impurity and the cell gas may be used without purification. The cathode product, hydrogen, is discarded but in commercial operation the HF would be recovered.

Critical Temperatures

Cady (*J.A.C.S.*, 1934, *56*, 1431) has shown that there are three regions of temperature and HF concentration suitable for electrolysis to produce fluorine. In each of these regions the system is liquid and the vapour pressure within practical limits. Excess HF loss occurs if this exceeds 5 cm. Hg.

The low-temperature region, used by Moissan, has the disadvantage of requiring below −30° C. which is hard to maintain; here also it appears necessary to use noble metal electrodes. The high-temperature region is reported to have been used on a commercial scale in Germany during the war. A temperature of about 250°C. is necessary and close control is required, since the permissible range of composition and temperature must be held within narrow limits. In this case, however, it is possible to use graphite anodes which have better electrical and mechanical properties than carbon.

Commercially, the region in the middle temperature range (95°-100°C.) is considered to have the best characteristics and is the one used by Pennsalt. Operating temperature is convenient to maintain and less rigid control is required because of the fairly wide range of composition and temperature in which it is possible to operate.

Perhaps the most important process variable is composition of the electrolyte. It is controlled by addition of A.H.F. using liquid level as a guide with an occasional check by chemical analysis. Since only HF is consumed, it is the only variable which will cause changes in liquid level. A.H.F. is thus added to the melt at a rate necessary to compensate for dissociation. Rapid absorption of the A.H.F. in the melt occurs and thorough mixing is aided by the gas lift at the electrodes. No other agitation is required.

Electrolyte composition is maintained at 38-40 per cent. A.H.F. This is important. If the concentraton of HF is allowed to rise, the vapour pressure increases, causing undue loss of HF, in both the fluorine and hydrogen. On the other hand, if the concentration of HF is low, the melting-point of the electrolyte may rise to the temperature at which solidification begins.

Another critical factor in cell operation is temperature. While the cell will operate within fairly wide temperature limits it is desirable to control it rather closely to attain uniform, efficient operation. Here the temperature is held in the neighbourhood of 95° C. Although at the start of operation the cell must be heated to fuse the electrolyte, once electrolysis has begun sufficient heat is generated to require cooling of the cell by circulating water through the cell jacket instead of steam.

Actually, the exact temperature of operation for a particular cell design depends on a number of factors. Again, it is a question of economics. Generally, a higher temperature is desirable from the standpoint of cell efficiency. This increases conductivity so that a lower voltage may be used and less power consumed. Conversely, however, higher temperatures increase the vapour pressure of the electrolyte, causing increased evaporation of HF with consequent loss.

Impurities

Relatively pure raw materials are necessary to ensure uniform operation and a high-purity product. Moisture, in particular, causes difficulty because it electrolyses to form O_2 or F_2O, and may also contribute to the "anode effect." Tentative raw material specifications which have proved satisfactory at Pennsalt are given herewith.

The following maximum percentages of impurities in KHF_2 are permitted: K_2SiF_6, 0.2; SO_4, 0.1; Cl, 0.05; H_2O, 0.05 per cent. maximum loss in 1 hr. at 100°C. Even more important is the purity of A.H.F. Since this is consumed by electrolysis, concentration of impurities may build up in the electrolyte. Maximum percentages of allowable impurities are as follows: H_2SiF_6, 0.1; SO_2, 0.06; H_2SO_4, 0.004; H_2O, 0.2.

A common difficulty in many electrochemical operations employing fused salt electro-

lytes is also observed in the fluorine cell. The "anode effect" or "polarisation" as it is often called, results from the spread of a film of fluorine gas over the surface of the carbon anode, which prevents the anode from functioning. It causes a sudden increase in cell voltage and a decrease in cell current. This phenomenon is not wholly understood but appears to be correlated with a critical range of moisture content in the electrolyte. The "anode effect" is most serious in an intermittent operation, but where a cell operates continuously, using a strictly anhydrous grade of electrolyte, it is of little consequence. When the "anode effect" does occur, it may be overcome by temporary substitution of a nickel anode for the carbon anode.

The gas barrier, which normally "floats" in an electrically neutral condition between anode and cathode, must be checked frequently against insulation failure by measuring the voltage between it and each of the electrodes. If the insulation between barrier and cathode fails, the steel barrier acts as a cathode, with the result that hydrogen may be generated in the fluorine zone, causing the two liberated gases to recombine explosively. Severe corrosion may occur if the insulation between barrier and the anode should fail.

Under proper conditions, operation of the fluorine cell is smooth and safe. Faulty operation, however, may cause explosions of varying degrees of intensity. Thus, the failure of the cathode-barrier insulation, as noted above, may produce a continuous crackling sound as the gases recombine. Excess back-pressure in the fluorine line may force the gas beneath the barrier into the hydrogen zone, producing heavy, rumbling explosions. The most severe explosions will result from leakage of air into the hydrogen zone and ignition of the mixture by stray bubbles of fluorine. To prevent damage to the cell in the event of unusually severe explosion, emergency plugs are installed in the cell cover to relieve excess pressure.

Materials of Construction

Fluorine can be handled at atmospheric or moderately elevated temperatures in several metals with little or no corrosion. These include iron (low carbon steel), copper, magnesium, nickel, and Monel. In these materials, an adherent fluoride film appears to give the necessary protection to the metal surface. The gas is piped in steel or copper, but valve seats and stems, where abrasion occurs, are preferably made of Monel. Certain plastics have been found valuable as packing and gasket material. Carbon anodes are not noticeably eroded by the electrolysis, but sometimes fail by cracking or splitting. Graphite and nickel anodes are unsatisfactory.

One of the major problems was that of developing suitable containers for storing and shipping fluorine. Steel cylinders with a special valve-packing material were finally adopted. These contain about ½ lb. of fluorine at 400 lb./sq. in. in pressure. Purified gas is compressed into the cylinders behind a ½-ton steel barrier through which the operation is remotely controlled. This barrier is fitted with a sight window of 2-in. thick bullet-proof glass covered on the inside with Plexiglass to prevent the glass from etching. The reason for this precaution is to protect the operator from direct impact of any possible explosions.

Further precautions are taken to ensure safety of the fluorine cylinders in transit. They are stored for a period of a few weeks at a temperature of 130° F., during which time the pressure of each cylinder is checked at intervals. This betrays any cylinder leakage which might cause trouble and endanger personnel during handling.

New Products

Availability of fluorine may be expected to intensify the research in the field of fluorine compounds that has been going on steadily over the past few years.

Many promising new products are still in the development stage. One of these is an organic fluoride liquid (a highly fluorinated hydrocarbon) non-inflammable and non-toxic, with a high enough boiling point and specific gravity to replace mercury in the present mercury vapour boiler. Another is a gas, sulphur hexafluoride, already developed but requiring elemental fluorine to manufacture, said to be a more nearly perfect insulator than is at present available for high voltages used in X-ray and nuclear physics work. Other developments include a highly stable synthetic lubricating oil, insecticides, anæsthetics, solvents, fireproofing materials, resins, and plastics.

BRITISH INDUSTRIES FAIR

The first British Industries Fair since 1939 is to be held from May 5 to 16 next year at Earls Court and Olympia, London, and at Castle Bromwich, Birmingham. As in pre-war years, exhibits will be grouped in two main sections, the lighter industries in London and the engineering and hardware at Birmingham. The London section of the Fair is organised by the Export Promotion Department, Board of Trade, 35 Old Queen Street, London, S.W.1, and the engineering and hardware section by the Birmingham Chamber of Commerce, 95 New Street, Birmingham, 2. Special attention will be devoted to the display of United Kingdom products suitable for export and it is hoped the Fair will attract many buyers from abroad as well as buyers in Britain. Application forms for space are now being sent to manufacturers.

German Technical Reports

Latest Publications

SOME of the latest technical reports from the Intelligence Committees in Germany are detailed below. Copies are obtainable from H.M. Stationery Office at the prices stated. The current list includes reports from the Joint Intelligence Operations Agency (JIOA).

CIOS XXXII—58. Chemical compositions of German pyrotechnic smoke signals (3s.).

CIOS XXXII—68. Manufacture and application of lubricants (4s. 6d.).

CIOS XXXII—119. Ruhr and Salzgitter Area: Iron and steel industry. (12s. 6d.).

BIOS 257. Metallgesellschaft A.G., Frankfurt: Chemicals for phosphating iron and steel (1s.).

BIOS 328. Antimony smelting industry (3s.).

BIOS 441. Platinum metals industry (6s.).

BIOS 522. I.G. Farben A.G., Höchst: The de-ashing of coal by combined jig washing, froth-flotation and extraction with caustic soda (2s.).

BIOS 524. Deutsche Gasolin A.G., Hamburg: Lubricants (4s. 6d.).

BIOS 531. Steel drum industry (9s.).

BIOS 541. Some German methods of grading and surface coating of abrasives (1s. 6d.).

BIOS 554. Ampoule and vial-making machines: improvements and developments (1s. 6d.).

BIOS 560. I.G. Farben Fabrik, Wolfen: Distillation of phenols (1s.).

BIOS 562. Phosphorus industry at Bitterfeld and Piesteritz (6s. 6d.).

BIOS 582. Interrogation of Dr. Lochfert, Rhenania Phosphat Werke, Brunsbuttelkoog (1s.).

FIAT 67. Chemical developments and applications in the synthetics industry. (6s. 6d.).

FIAT 144. I.G. Farben, Dormagen: Acetic acid recovery, aceto-butyric acid recovery, propionic acid recovery (1s.).

FIAT 229. Copper, lead, zinc, tin, and antimony smelting and refining in North-Western Germany (4s. 6d.).

FIAT 239. Hoesch Benzin, A.G., Dortmund: Fischer-Tropsch plant (6d.).

FIAT 276. Kaiser Wilhelm Institut für Kohlenforschung, Mülheim, Ruhr: Interrogation of Dr. Helmuth Pichler and Professor Karl Ziegler. Information concerning "Isosynthesis." Comparative experiments with iron catalysts (1s. 6d.).

FIAT 293. I.G. Farben, Leverkusen: Information on recoil fluid used by German Army; synthetic lubricating oils from tetrahydrofuran; additive for break-in oil (1s. 6d.).

FIAT 408. Dr. Ing. A. Thau, Didier Werke A.G., Berlin: *Metallurgical coke* (9s. 6d.).

FIAT 500. Design of acetylene cylinder filling plants, 1945 (1s. 6d.).

FIAT 511. Acetylene generator designs, 1945 (2s. 6d.).

FIAT 513. I.G. Farben, Hoechst: Study of hydrogen and methane production from coke oven gas (5s. 6d.).

FIAT 528. Light-sensitive reproduction materials (7s. 6d.).

FIAT 531. Roechling'sche Stahlwerke Voelkingen, Saar: Study of metallurgical coke—developments in methods of production and testing (11s. 6d.).

FIAT 577. Survey of the leading manufacturers of pressure vessels (4s. 6d.).

FIAT 712. Desmodur R.: Manufacturing process of a synthetic adhesive (1s.).

FIAT 801. Industrial safety (13s. 6d.).

JIOA 23. Recovery of vanadium from iron and steel plant slags (1s.).

JIOA 28. Air-foam fire-fighting equipment (21s.).

JIOA 34. Chemical fire extinguishers (9s.).

JIOA 40. Oil refineries (5s. 6d.).

New I.C.I. Laboratories

Fundamental Research in Industry

IMPERIAL Chemical Industries have leased the house and laboratories at The Frythe, Welwyn, Herts, for long-term general and academic research in branches of biological, chemical and physical science. Among the subjects to be studied are the antibiotic products of moulds, kinetics of continuous chemical reactions, and the deformation of materials under high stresses of short duration. Work will also be done on the design of industrial instruments and on industrial toxicology.

The new laboratories will eventually house twenty or more senior research workers, with assistants and administrative staff. Some of the staff have already been recruited, but have hitherto been scattered in various localities while engaged on war-work.

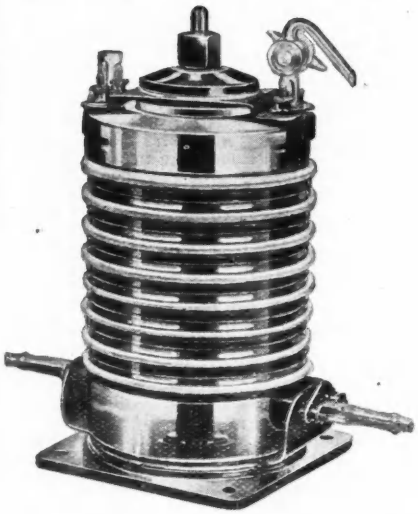
The premises at The Frythe are intended as temporary accommodation until a site at Butterwick Wood, near St. Albans, which was originally selected, can be developed. The activities of the Butterwick Research Laboratories will be completely independent of all other I.C.I. research departments, which will continue to be concerned with more specifically industrial problems.

Laboratory Equipment

New Items of Interest

FROM A. Gallenkamp & Co., Ltd., 17-29 Sun Street, Finsbury Square, E.C.2, we have received copies of recent publications describing new laboratory equipment, some of which is of particular interest.

There is, for instance, the " P.G. 14 " filter press, which has been designed for the filtration of chemical, bacteriological, and pharmaceutical products where it is essential to ensure the utmost cleanliness, sterility, and immunity from attack of corrosive liquids, or metallic contamination of the liquids. The filter is thus made of Hysil glass throughout, with the exception of the



The " P.G.14 " laboratory filter press.

stainless steel clamping bolts, which do not come into contact with the liquid that is being filtered. The passage of liquid through the filter can be watched and its condition observed. The loss of valuable liquids is obviated by the completeness of draining at the end of a run, this being made possible by the vertical working position of the filter and the design of the channels. The lower portion of the filter can be used for clarifying and the upper portion for sterilising by means of a transfer plate, which makes a useful accessory.

Among a wide range of glassblowers' tools is a new " Gallenkamp " blowpipe, which replaces the previous model. It is a simple, powerful burner, capable of giving a variety of flames suited to all operations in general laboratory glassblowing. The burner tubes and fittings are finished in bright nickel plate. A grey enamelled casting of pleasing and stable shape forms the base, while the

The new " Gallenkamp " laboratory-pattern blowpipe.

stand is a polished aluminium alloy die casting, with a U-notch for cutting and shaping glass. With the blowpipe are supplied three interchangeable jets.

Other new equipment includes electric ovens of advanced design and electrically heated tube furnaces.

Fisons' Expansion Plans

Negotiations with Genatosan.

THE chairman of Genatosan, Ltd., announces that negotiations are proceeding with Fisons, Ltd., by which the latter company will make an offer of equivalent to 12s. 6d. per share for the whole of Genatosan's outstanding 1s. ordinary shares. Fisons already hold a controlling interest in the other company.

In a review of the current year, the chairman of Fisons, Mr. F. G. Clavering Fison, reported that his company would undertake expenditure of not less than £3,000,000, to be spread over a period of three years. As already reported, a new factory is to be erected at Immingham, with a capacity of 100,000 tons per annum, and work has been started at Avonmouth to permit of an additional annual capacity of 75,000 tons. Among the products to be turned out at Immingham is triple superphosphate, not hitherto manufactured in this country.

New Control Orders

Exemptions from Key Industry Duty

THE Treasury has made an Order (S. R. & O. 1946, No. 1340), which became effective on August 14, exempting the following from Key Industry Duty until December 31, 1946.

Analysers and polarisers consisting of a film of polarising material mounted between glass discs or plates. Fermentographs for measuring and recording carbon dioxide evolved during dough fermentation; integrators (planimeter type). Sealed cylindrical X-ray tubes having two or four windows.

Celtium oxide; dysprosium oxide; erbium oxide; europium oxide; gadolinium oxide; holmium oxide; lutecium oxide; scandium compounds; terbium oxide; thulium oxide; ytterbium oxide.

Acetamidosalol (acetylamido phenol salicylate); acid adipinic; R. acid carbolic; acid carbolic (synthetic); acid dipropylmalonic; acid filicic; acid maleic; acid propionic; acid succinic, but *not* acid *iso*succinic (acid methyl-malonic).

Acid *iso*butyl allyl barbituric; acid *iso* propyl barbituric; *iso*-amyl ethyl barbituric acid; *N*-methyl ethyl phenyl malonyl urea; sodium ethyl methyl butyl barbiturate; sodium *iso*-amyl ethyl barbiturate.

Alcohol amido-ethyl; alcohol dodecyl (alcohol duodecyl); alcohol isopropyl, unrefined, containing not less than 0.5 per cent. by weight of ketones. Alcohol propylene; allyl paracetamino-phenol; amido-guanidine sulphate; amidopyrin (dimethyl-amidoantipyrine); amidopyrin-barbitone; R. benzophenol; benzophenol (synthetic). Butyl methyl adipate; camphene; carbamide; caesium bromide; ethyl cellulose; cocaine, crude; pseudo-cumenol.

Crystals, not optically worked, weighing not less than 2.5 grams each, consisting wholly of one of the following: barium bromide; R. barium chloride; barium fluoride; barium iodide; caesium chloride, caesium iodide; calcium bromide; R. calcium chloride; R. calcium fluoride; calcium iodide; lithium bromide; lithium chloride; lithium fluoride; lithium iodide; R. magnesium oxide; potassium bromide; R. potassium chloride; potassium fluoride; potassium iodide; rubidium bromide; rubidium chloride; rubidium fluoride; rubidium iodide; sodium bromide; R. sodium chloride; sodium fluoride; sodium iodide.

Methyl cyclohexanol methyl adipate; dicyandiamide; didial (ethyl morphine diallyl barbiturate); *p*-di-ethoxy ethenyl diphenyl-amidine and its hydrochloride; diethyl amino-ethanol; diethylamine; diphenyl; diphenyl oxide; elbon (cinnamoyl para-oxyphenyl-urea); emetine; emetine bismuth iodide; emetine hydrobromate; emetine hydrochlorate; ethyl abietate; hydrogenated ethyl abietate; ethyl benzoyl-benzoate; Eukodal; furfural; germanium oxide.

Diglyceryl tetra-acetate; glycol ethers; guanidin carbonate; guanidin nitrate; guanidine sulphate; guanidin sulphocyanide; Kryofin; lipoidin; maleic anhydride; R. mannite (R. mannitol); menthyl ethyl glycollate *N*-(oxy - aceto - mercuric - propyl)-ethylurethane; methyl amidoxy-benzoate.

Hydrogenated metthyl abietate; methyl abietate; oxymethyl *para*-oxyphenyl benzylamine methyl sulphate; methyl-sulphonal (diethylsulphonemethylethylmethane, trional); methylene chloride; α-naphthyl *iso*thiocyanate; nickel hydroxide. Sodium diacetyl sulpho-succinate.

Copper methyl arsenate; 4-oxy-3-ethyl-amino-phenyl arsinic acid; *N*-methyl tetra-hydro-pyridine β-carboxylic acid methyl ester; oxy-acetophenone, *meta-*; phenetidine, *ortho-*; phenetidyl-phenacetin and its hydrochloride; phenol (synthetic), R. phenol; phytin; piperazine (diethylene-diamine, Dispermin); potassium ethyl xanthogenate (potassium xanthogenate); potassium guaiacol sulphonate; R. potassium hydroxide (R. potassium caustic, R. potassium hydrate); safrol; sodium phenyl dimethyl pyrazolone amino-methane sulphonate; sulphonal; theophylline; urea; veratrine; xylol, *meta*; xylol, *para*.

Vanadium-silica compounds specially prepared for use as catalysts for sulphuric acid manufacture.

Soya Flour

The Soya Flour (Control and Maximum Prices) Order, 1946 (S. R. & O. 1946, No. 1344) replacing the corresponding 1943 Order, came into force on August 11. By this Order the maximum price of soya flour on a sale of 28 lb. or more is increased from £32 5s. to £52 5s. per ton, and on a sale of less than 28 lb. from 5d. to 7½d. a lb. The prepacking of soya flour except under licence is prohibited.

Protective Clothing

An amendment (S. R. & O. 1946, No. 1379) of the General Licence S. R. & O., 1944. No. 802, operative from August 16, makes the following additions to the list of persons who may sign type "K" coupon-equivalent certificates for the provision of protective clothing: A person authorised by the Ministry of Health or by the Board of Trade; the Clerk to the Council of the Chartered Society of Physiotherapy; the Registrar of the Board of Registration of Medical Auxiliaries; the Secretary of the British Medical Association; the Hon. Secretary of the Northern Ireland District Dental War Committee; the General Secretary of the Institution of British Launderers; and the Secretary, Registrar or Bursar of a University or University College in Great Britain in receipt of a Treasury Grant.

Personal Notes

MR. H. C. D. LOCK has been appointed an additional director of British Glues & Chemicals, Ltd.

MR. ROBERT FOOT, chairman of the Mining Association, has joined Powell Duffryn as a managing director, replacing Lord Hyndley.

MR. K. W. L. KENCHINGTON, Woolwich Arsenal, and MR. G. E. C. WATTS, Colne, Lancs, were successful in the Textile Institute's recent examination in the Analysis and Testing of Textile Materials.

MR. C. BELKNAP, chairman of the board of the Monsanto Chemical Company, St. Louis, U.S.A., is retiring on October 1 to become vice-chancellor of Washington University, St. Louis.

MR. H. L. DERBY, president of the American Cyanamid and Chemical Corporation, has resigned from all activities connected with that concern. He has also retired from the presidency of the Manufacturing Chemists' Association of America, being succeeded in that office by MR. C. S. MUNSON, of U.S. Industrial Chemicals.

MR. SAMUEL COURTAULD, who will complete 25 years as chairman of Courtaulds, Ltd., on October 24, is to relinquish his chairmanship on that date, on grounds of health, though he will remain a member of the board. MR. J. C. HANBURY-WILLIAMS has been elected to succeed Mr. Courtauld as chairman, and on assuming that office will relinquish his managing directorship.

MR. THOMAS PENNY, a member of Lever Brothers' board, Port Sunlight, since 1940, has been appointed chairman of Joseph Watson & Sons, Ltd., Leeds, taking over at the end of the year. He will be succeeded as technical director of Lever Brothers, Port Sunlight, by MR. J. P. BRIERLEY, at present technical director of the Lever Brothers Co., Canada.

The director of the National Paint Federation announces the appointment of MAJOR JOHN BAXTER as Statistical Officer with the Federation. This is the first appointment to be made under the scheme for the reorganisation of the Federation's Secretariat. Major Baxter is at present employed with the Scottish Special Housing Association, Edinburgh. He takes up his new duties with the Federation on September 2.

DR. CHARLES A. H. WRIGHT has been elected president of the Chemical Institute of Canada, in succession to Dr. R. R. McLaughlin, the first president. Dr. Wright is consulting chemical engineer of the Consolidated Mining and Smelting Co., Ltd., whose lead and zinc works at Trail, British Columbia, are the largest non-ferrous metallurgical plant in the world. Dr. Wright was the first engineering graduate of the University of British Columbia. He took the Ph.D. degree at McGill and studied for a year as Ramsay Memorial Fellow at University College, London. He has been with Consolidated Mining and Smelting since 1925, but he maintains also an interest in academic affairs, being a member of the Senate of the University of British Columbia.

Obituary

MR. ROBERT HENRY CLAYTON, a director of the associated companies of Hardman & Holden, Ltd., and Manchester Oxide Co., Ltd., died at his home in Didsbury, Manchester, on August 12 at the age of 74. Mr. Clayton had been connected with these companies for over 50 years and had been a director for 43 years. He was also a director of the Cortonwood Collieries Co., Ltd. He was actively interested in the affairs of Manchester University, being a member of the Court of Governors and a past chairman of Convocation. Mr. Clayton was a prominent member of the Manchester Literary and Philosophical Society of which he was president from 1937-1939 and treasurer for many years.

Scottish Seaweed Industry

Discouraging Labour Situation

DESPITE considerable encouragement, and high wages and prices, seaweed gathering and processing in the West of Scotland is progressing slowly because of acute shortage of labour. There is at the same time a considerable labour potential in the islands, the position being that the islanders show a definite reluctance to work to modern commercial requirements. Difficulty has been experienced in obtaining all the seaweed required to work to capacity, and imported seaweed from Ireland is actually being used to feed the plant established in South Uist. This winter mechanical methods of harvesting will be employed, harrows drawn by tractors being used to collect the weed from the shore, and conveyor belts to deliver it to the plant. The seaweed is sun-dried and then kiln-dried before being broken, crushed, and milled. Plans for a modern plant capable of drying 200 tons per day have been meantime delayed because of the difficulty of obtaining an adequate flow of the required raw material. Islanders are paid £3 5s. per ton dry and £2 per ton wet seaweed, and in a short season can earn substantial sums. The real trouble is that the development of modern industry is not regarded with favour and that, with the exception of a limited group of island workers, the average islander is not disposed to encourage the invasion by non-islanders.

A CHEMIST'S BOOKSHELF

ORGANIC QUALITATIVE MICROANALYSIS. By Frank Schneider. London: Chapman and Hall. Pp. 218. 21s.

Readers in this country will undoubtedly be somewhat startled by the statement, in the introduction to this book, that although the value of organic [qualitative] analysis as a method of instruction in organic chemistry has long been realised, many colleges and universities have hesitated to offer such courses because of the expense and space required. This statement, it may be explained, refers to the United States. In the reviewer's experience, at least, a major part of organic practical instruction in this country is concerned with the methods of qualitative analysis and the procedures arising from these methods. British chemists will need no special pleading to convince them of the worth of such teaching.

That micro methods, so far unaccountably neglected in this branch, as Dr. Schneider remarks, should be developed, is a logical outcome of present-day trends, which have led to the widespread introduction of, for example, inorganic qualitative small-scale methods. A student using the methods would learn much about the theory of organic chemistry, he would not lose any valuable technique, since he would undoubtedly continue to carry out a reasonable selection of synthesis on the full scale; and he would save time and material. The practising analytical chemist, also, would find the small-scale methods as reliable as the large-scale, and would gain in speed and convenience. Consequently, the appearance of Dr. Schneider's book, based on his well-known published papers in this field, of which he has been one of the pioneers, has been looked forward to with some eagerness.

The reviewer must confess, after studying the book, to a feeling of some disappointment. This is not because it is a poor book; it is anything but that. It is because the whole of the book does not reach the high standard of some of its parts.

Some detailed examination of the aim of the book, in conjunction with its achievement, is called for. On the jacket it is claimed that we have, within the book, "complete and detailed instructions for the preparation, isolation, purification, and identification of very small quantities of organic compounds." However, we find, in fact, that the book must be used in conjunction with one or other of several listed standard works on the identification of organic compounds. Without such aid, unless the worker had already a sound knowledge of organic chemistry, and could read between the lines with some ingenuity, it is doubtful whether he could *identify* a single organic compound.

The opening chapter, on general methods, will be valuable to those unacquainted with microchemical technique. This is followed by a lengthy section on purification of the sample. This section provides an excellent collection of micro methods—distillation, crystallisation and other organic operations. It is very fully and clearly illustrated, and useful references are given. But it is much too uncritical. One feels very strongly that the author, who must have tried most of the methods described, should be able to give more specific guidance from his experience.

The chapter on the detection of elements is well done, although the reviewer is not convinced that the simplest methods are described. This, however, is a matter for debate, and it is not proposed as an adverse criticism. In the section dealing with the determination of physical properties we are once more presented with too great a wealth of material. It would have been preferable to describe fewer methods if some clearer indication of reliability and convenience were given.

It is in the latter half of the book that the reviewer finds the greatest pleasure, and, paradoxically, the greatest disappointment, since it is from this stage that the worker will have to proceed with two text-books on his bench. This portion of the book deals with the classification of compounds into groups by micro tests, and the preparation of appropriate derivatives. If this were combined with tables giving the determinable values for a selection of compounds, however small, then the book would have fulfilled its function. But apart from a few isolated tables, not readily available, this is not done. Thus, it is possible for the worker to identify a compound as, say, a ketone. With this, lacking another reference book, he must be content.

The descriptions of the tests, and the directions for syntheses are admirably clear, and they alone would make the book invaluable. It is to be hoped that the later groups, containing compounds "of higher orders," will ultimately be dealt with in the same intensive fashion as the compounds of carbon, hydrogen, and oxygen. The inclusion, too, of some halogen compounds under compounds containing nitrogen may, failing further explanation, be confusing.

If the reviewer seems to have dealt unduly hardly with this book, it is because he feels so warmly concerning the need for a book such as this purports to be. The present work has got well on the way to fulfilling the need. There is no other book which gives half the information contained here. There is, indeed, no other book known to the reviewer in the same field, and it is palatably presented. In future editions it is to be anticipated that Dr. Schneider will present us with a true chemical classic.

CECIL L. WILSON.

General News

Telephone service has been reopened with Chile, Paraguay, Peru and Uruguay and will be available between 2 p.m. and 8 p.m. every afternoon.

The City Library, Brunswick Road, Gloucester, has been added to the list of public libraries at which intelligence reports on German industry may be consulted.

The season of extension courses at Manchester University starts on August 26 with a fortnight's advanced course in physical chemistry by Professor M. Polanyi and others.

Zinc naphthenate is covered by a new specification D.T.D. No. 759 (6d.); revised specifications dealing with magnesium alloy castings are Nos. 136B, 281A, 289A (1s. each), superseding 136A, 281 and 289.

A new factory for the manufacture of conveyor belting is to be erected by Turner Bros. Asbestos, Ltd., at Hindley, in the S. Lancashire development area. About 900 persons will be employed in it.

The Scientific Film Society has arranged to show every month a programme of scientific and documentary films. Performances will be at the Scala Theatre, London, W.1, and will be given on Sunday afternoons and evenings, beginning in September.

Work started this month in the new factory of the East Anglia Chemical Co., Ltd., Aycliffe Trading Estate, Darlington, operations having been transferred from Nuneaton without a hitch. The move was necessitated by a considerable expansion in the company's production of lacquers and plastics.

The North of England Institute of Mining and Mechanical Engineers, Neville Hall, Newcastle-upon-Tyne, is anxious to bring its collection of safety lamps up to date as far as possible. The council will be grateful to receive from members (or others) any lamps in their possession for inspection and cataloguing. Any lamps received that are already in the Institute's collection will be returned to their owners.

A limited number of permanent commissions in the Engineering Branch of the Royal Navy will shortly be granted. Applicants must be British subjects, under the age of 26 on December 31, 1946, and possess one of the following: University degree in Engineering, a Higher National Certificate in Engineering, or the Ministry of Education Diploma in Engineering granted to Engineering Cadets. Full particulars may be obtained on application to The Secretary of the Admiralty, (C.W. Branch II), Admiralty, London, S.W.1.

From Week to Week

The United States and Great Britain, according to a *Journal of Commerce* despatch from Washington, are planning to hold talks this autumn with a view to setting up a world oil agreement and an international oil organisation under the United Nations.

A factory, providing employment for 500 people, is to be established at Ulverston-in-Furness by Glaxo Laboratories Ltd., on a site used for many years as an ironworks. The firm have arranged to purchase the site from the North Lonsdale Iron and Steel Company, Ltd.

I.C.I. stock and share department returned to London on August 21, from its war-time evacuation at Kendal, and is now at 34 Portland Place (LANgham 3454). Practically all the administrative departments of the company are now distributed in various offices in London.

The first of the British Celanese developments at Marchwiel, Wrexham, will be the establishment, probably next month, of a plastic department providing immediate employment for 200 people. Eventually, employment will be provided for about 3000 women and 2000 men.

A new laboratory for atomic research will be ready in October at Durham University. Professor F. A. Paneth, Professor of Chemistry at the University, who, during the war worked on atomic research in Canada on behalf of the Government, will be in charge, and will be assisted by three other scientists.

Fertiliser and chemical manufacturers in Leith are being severely hampered by the shortage of female workers which is now generally felt in the area. In many instances plants are working to only a fraction of total capacity, and have been forced to lay off certain departments and concentrate available labour in others. In Leith some 290 women are wanted, according to M.O.L. statistics, almost all for fertiliser manufacturing.

The Toilet Preparations (Consolidation) Order, 1946, (S.R. & O. 1946, No. 1372) revokes and re-enacts in consolidated form Nos. 3, 4, 5 and 6 Orders. Registered manufacturers of toilet preparations will now be permitted to mark their goods with brand names or trade marks; provision is made for the distribution of imported goods on the home market; and a new form of return, T.P./6, for goods manufactured and supplied by registered manufacturers, replaces form T.P./5.

In addition to the figures quoted on p. 242, the following changes have been made in the prices of refined oils and fats allocated to primary wholesalers and large trade users for the eight-week period ending October 12: Empire stearine, per ton c.i.f. £62 (in hardwood barrels 25s. per ton extra); premier jus (S. American), £73 15s., oleo oil, £90 (in softwood barrels or tierces, 25s. per ton less).

Three new "Trading with the Enemy" Orders (S.R. & O. 1946, Nos. 1373-5) signed on August 13 have the general effect of permitting trade with Austria and removing Board of Trade and Custodian control over money and property accruing in consequence of this authorisation. Austrian property, etc., in the U.K. continues under such control. Import and export licences can be obtained in the usual way, and traders are reminded that exchange control requirements must be complied with.

Government purchase of tungsten and molybdenum ores and concentrates has now practically ceased, and it has been decided to return to private trading in these materials. Purchase and import on private account may now be resumed, subject to import licence, applications for which should be made on the usual form, which should be forwarded to the Iron & Steel Control, Ministry of Supply, Artillery Mansions, 75, Victoria Street, London, S.W.1, for transmission to the Import Licensing Department.

Foreign News

A State monopoly has been established in Hungary for the purchase and sale of saccharin.

This year's American National Chemical Show will be held in Chicago concurrently with the meeting of the American Chemical Society, from September 9 to 13.

It is reported from Rhodesia that between 18,000 and 20,000 long tons of copper have been lost as a result of the strike in the mines there, which has lasted since July 15.

The Italian Government has granted a sum of 300 million lire to be used in the restoration of the Sardinian coalmines worked by the Società Carbonifera Sarda.

Bolivian output of antimony for 1945 was 5535 metric tons, all of which was exported: to the U.S., 5192 tons; to the Argentine Republic, 319 tons; to the U.K. 24 tons.

The editorial offices of the *Journal of Chemical Education* are moving, about September 1, from Brown University, Providence, R.I., to Scripps Institution, La Jolla, California, U.S.A.

The antimony mines at Cucma in eastern Czechoslovakia are again in working condition after damage caused by the Germans has been made good. Output amounts to 6 tons of amorphous antimony daily.

The nomination of works councils, composed of representatives of the workers and clerical staff of the Montecatini group, was agreed to at a meeting held on August 7 in Milan.

In French Morocco, the Bou Azzer cobalt mine produced about 70 tons (metric) a month during 1945. Demand from France for the mineral improved latterly, though it is reported that a stock of 3000 tons was in hand at the mine at the beginning of 1946.

A Federal Grand Jury at Denver, Colorado, has charged six corporations and five individuals with conspiring to fix prices and monopolise the U.S. vanadium industry in violation of the Sherman Anti-trust Act. The corporations concerned are the Union Carbide and Carbon Corporation, with four wholly-owned subsidiaries, and the Vanadium Corporation of America.

The chemical products department of the Standard Oil Company (Indiana) announces that it has now produced, in small quantities for research work, the sulphonic acids of methane and ethane, as well as mixed paraffin sulphonic acids. It is claimed that metal plating can be considerably speeded up by using these acids, which are said also to give brighter finishes.

A simple method for reclaiming contaminated rhodium plating baths is reported to have been developed by Abner Brenner and W. A. Olson at the Electrochemistry Section of the U.S. National Bureau of Standards. The undesirable metallic impurities are precipitated with potassium ferrocyanide and removed by filtration. The rhodium in the complex phosphate in the bath is not precipitated under the conditions of purification.

According to the Hungarian journal, *Villag*, a penicillin plant is to be erected at Budapest by United States interests, which will provide not only the necessary capital, but also all special machinery and equipment. Production will be based on U.S. patents, and it is reported that Professor Sztent-Györgyi will occupy a leading position in the new plant's scientific work. It is hoped that the plant will be working within about 18 months.

Forthcoming Events

September 10-11. Institute of Metals (Autumn Meeting). Institution of Civil Engineers, Great George Street, London, S.W.1. September 10, 2.30 p.m.: Official business, followed by three papers. September 11, 10 a.m.: Simultaneous groups of papers (in Lecture Hall and South Reading Room); 1.15 p.m., Annual luncheon at Connaught Rooms, Great Queen Street, W.C.2. Applications to the Secretary not later than September 1.

Company News

The London Aluminium Co., Ltd., which became a public company last June, is paying an interim ordinary dividend of 10 per cent.

The United Glass Bottle Manufacturing Co., Ltd., has increased its interim dividend from 3½ per cent. to 5 per cent.

Cellactite & British Uralite, Ltd., report a net profit, for the year ended March 31, of £27,619 (£6057). Ordinary dividend is 20 per cent. (7½ per cent.).

Boots Pure Drug Co., Ltd., is paying an interim dividend of 10 per cent. (same) on the ordinary capital in respect of the year ending March 31 next.

Metal Industries, Ltd., are paying a final ordinary dividend of 7 per cent., making 10 per cent. (9 per cent.) for the year ended March 31. Profit after depreciation is £294,897 (£266,548).

The International Nickel Co. of Canada reports a net profit, for the first half of 1946, amounting to $12,211,663 ($13,527,594), and is paying a dividend of 42c. per share on common stock for the second quarter (39c.), making 77c. (86c.) for the half year.

Timothy Whites & Taylors, Ltd., announce the proposed issue in the near future of 323,862 ordinary shares of 5s. each for expansion and development purposes. The necessary capital increase is to be effected, it is suggested, by the conversion of 100,000 of the unissued cumulative preference £1 shares into 400,000 5s. ordinary shares. Net profit for the year to December 29 last was £155,758 (£140,009). Total ordinary dividend for the year was 30 per cent. (same). Forward, £99,143 (£84,569).

New Companies Registered

Warner Chemical Co., Ltd. (417,084).—Private company. Capital £15,000 in £1 shares. To carry on business as indicated by the title. Subscribers: E. W. Geere (permanent governing director): S. L. A. Mastin. Registered office: 92 Victoria Street, London, S.W.1.

Richard Parry & Co., Ltd. (417,057).—Private company. Capital £2500 in £1 shares. Industrial painters, factory cleaners and degreasing, chemical and fuel engineers, etc. Directors: R. M. Parry; W. G. Parker. Registered office: 36 Cannon Street, Birmingham.

Haines Development Co., Ltd. (417,026).—Private company. Capital £3000 in £1 shares. Manufacturers of and dealers in wood-wool slabs, chemical and general engineers, etc. Directors: W. H. Haines; F. M. Ward Smith; V. R. Watling; and M. T. Amos. Registered office: 7/8 Norfolk Street, London, W.C.2.

Cogas Chemicals, Ltd. (417,010).—Private company. Capital £25,000 in £1 shares. Manufacturers of and dealers in coke-oven gas, and producers therefrom of chemicals of all kinds, plastic substances, etc. Directors: W. G. Bailey; Dr. G. Frenkel; Norman Sadler. Registered office: 329 High Holborn, London, W.C.1.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

BRITISH COAL DISTILLATION, LTD., London, S.W. (M. 24/8/46.) July 29, £3400 debentures, part of a series already registered. *£33,400. January 11, 1946.

CONSOLIDATED CHEMICALS, LTD., Bury St. Edmunds. (M. 24/8/46.) July 22, series of £8000 (not ex.) debentures, present issue £4600; general charge. *£2000. May 11, 1945.

Chemical and Allied Stocks and Shares

BRITISH Funds have continued firm, but chief attention in stock markets again centred on industrial shares, although profit-taking reduced some of the substantial gains recorded last week. There was widely-spread demand for iron, coal, and steel shares in view of the good yields ruling and hopes that dividends may be on a somewhat less conservative basis than during the war period. The prevailing assumption is that the Government's nationalisation plans may not be effected for two years or more.

Imperial Chemical at 45s. 6d. lost part of their recent advance, but attracted renewed attention at the lower level, as the yield offered compares favourably with the average return on other leading industrial shares. Moreover, the general belief is that there seem good prospects of the 8 per cent. dividend, which has ruled for some years, being maintained in future. The group has big

expansion schemes in hand from which earnings should benefit as time proceeds. Dunlop Rubber at 75s. 3d. also lost part of the good rise shown in recent weeks, and Turner & Newall eased to 89s. 3d., but United Molasses were favoured up to 55s. 9d. on the possibility of an increase in the interim dividend. The units of the Distillers Co. held firm at 139s., but elsewhere, British Plaster Board eased to 34s. 3d., and Associated Cement to 70s. 3d. A moderate decline to 40s. 9d. in Triplex Glass was attributed to market doubts whether there will be an increased dividend for the financial year ended June 30. On the other hand, United Glass Bottle ordinary were good at 93s. 9d., following the higher interim dividend; recently the company redeemed the whole of its debentures; but for many years earnings on the ordinary shares have been substantially in excess of dividend payments.

Weardale Steel deferred advanced to 44s., and Hilton Main shares rose to 41s., the latter on expectations that the final dividend will be at the same rate as the interim. United Steel were good at 26s. 3d., Dorman Long rallied to 27s. 6d., Staveley were 49s. 9d., and Shipley 36s. 6d. T. W. Ward also strengthened to 43s. 9d. Ruston & Hornsby were 64s. 3d., while Stewarts & Lloyds rose further to 52s. 6d., and Tube Investments were £6 3/16. Metal Box shares at £6 3/32 were higher again. B. Laporte remained firm at 100s., with W. J. Bush 87s. 6d., Burt Boulton 26s. 3d., Cellon 30s., and British Drug Houses 58s. Monsanto Chemicals 5½ per cent. preference were 25s., and Greeff Chemicals Holdings 5s. ordinary 12s. 6d. Fisons showed firmness at 60s. 6d. on the results and latest developments; while Genatosan 1s. ordinary were marked up to 12s. 6d. following the offer for the shares. Cooper McDougall were 42s. 6d. In other directions, introduction to the Stock Exchange of the 5s. ordinary units of the old-established manufacturing chemists' business of Stevenson & Howell attracted a good deal of attention, the quotation rising to 29s., compared with a placing price of 26s. 9d.

Boots Drug have been firm at 63s. 9d., while Sangers moved up further to 34s. 6d., and Timothy Whites were steady at 48s. 6d. on the full results. Lever & Unilever at 45s. 6d. failed to hold all an earlier improvement. Aspro shares continued active with dealings up to 38s. 9d., and Griffiths Hughes were 62s. 6d. Among plastics, De La Rue at £11⅞ lost part of their recent rise, British Industrial Plastics 2s. ordinary were 7s. 9d., British Xylonite were £7¼, and Erinoid were active around 16s. 6d. British Glues showed firmness at 15s. 7½d., and British Tar Products 2s. 6d. units were 11s. 10½d. Among Oils, Anglo-Iranian receded to 97s. 6d., and Burmah Oil at 70s. 7½d. eased earlier in the week on the news from India. British Borneo Petroleum showed a renewed rise to 30s. 6d., and elsewhere Mexican Eagle Oil became active on rumours of re-opening of compensation negotiations, which, however, lacked confirmation.

British Chemical Prices

Market Reports

A FAIR volume of inquiries has been circulating in the London general chemical market during the past week and the movement into consumption so far as the principal outlets are concerned has been on steady lines. The price position is unaltered and in most instances the undertone is very firm. Among the soda products there have been steady deliveries of refined nitrate of soda and hyposulphite of soda and available supplies of bichromate and yellow prussiate of soda are readily taken up. A rather tight position continues in the potash section where, with the possible exception of permanganate of potash, the volume of inquiries exceeds available supplies. In other directions a steady demand is reported for white powdered arsenic, formaldehyde, and peroxide of hydrogen. The coal-tar products market is without notable feature, quotations throughout continuing very firm with little on offer for spot or near delivery.

MANCHESTER.—Sellers on the Manchester chemical market have handled a fairly large number of fresh inquiries for both light and heavy products during the past week and these have resulted in useful additions to order-books. It is still the case that actual deliveries of textile and other chemicals against contracts are affected to some extent by holiday conditions in Lancashire towns, but the influence of these is gradually becoming less pronounced and will cease altogether within the next few weeks. Strong price conditions are reported in almost all sections of the market. There is a steady offtake of the principal tar products and a fair amount of new business has been reported.

GLASGOW.—The Scottish heavy chemical market showed considerable activity during the past week. All classes of light and heavy chemicals were in demand in the home market, with prices everywhere on the upgrade. Supplies, of course, are still difficult and in no commodity appear to meet the demand. Inquiries from overseas markets were normally busy and reflected the world need for raw materials of all kinds. Prices in this case also were very firm with, in many cases, a tendency to increase.

Price Changes

Whale Oil: Refined hardened deodorised, per ton naked ex works, 42°, £89; 46/48°, £90.

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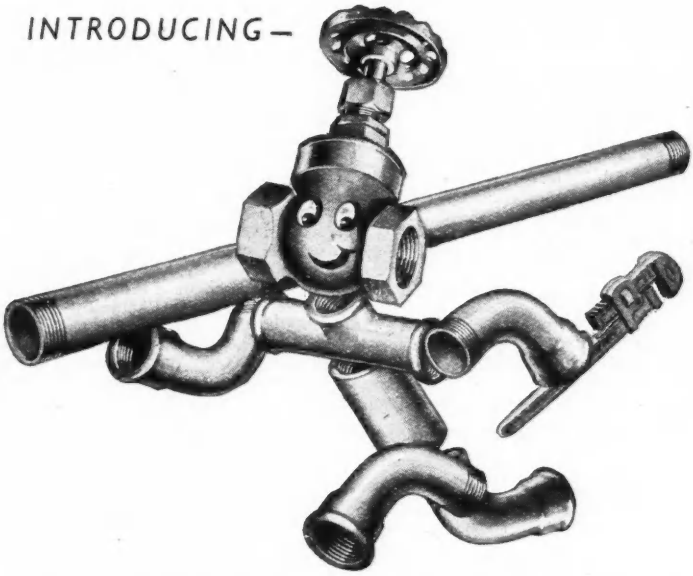

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Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Pteridines.—American Cyanamid Co. 22289-92.

Hydrocarbons.—C. Arnold (Standard Oil Development Co.). 22564.

Organic nitriles.—C. Arnold (Standard Oil Development Co.). 22565.

Volatile fuels.—C. Arnold (Standard Oil Development Co.). 22566.

Benzoate.—R. G. Blumenthal. 22376.

Dyes.—British Celanese, Ltd. 22078.

Ethers.—British Drug Houses, Ltd., F. M. Berger, W. Bradley, and A. C. R. Dean. 22025-6.

Ethers.—British Drug Houses, Ltd., W. Bradley, J. Forrest, and O. Stephenson. 22085.

Ascorbic acid stabilisation.—Abbott Laboratories. 22876.

Ethyl alcohol.—C. Arnold. (Standard Oil Development Co.) 22725.

Treatment of oils.—D. Balachowsky. 22796.

Glyceride oil compositions.—Best Foods, Inc. 22839-41.

Powdered metals.—Birmingham Small Arms, Co., Ltd., S. C. Wilsdon, and P. J. Ridout. 22775.

Nitrogen compounds.—G. D. Buckley, N. H. Ray, and I.C.I., Ltd. 22790.

Lubrication.—Carbide & Carbon Chemicals, Inc. 23095.

Electroplating.—Carnegie-Illinois Steel Corporation. 22987.

Sodium chromate.—Chrome Metals (Aust.) Pty., Ltd. 22723.

Polymeric materials.—J. G. Cook, D. A. Harper, and I.C.I., Ltd. 23071.

Biguanidine derivatives.—A. F. Crowther, F. H. Curd, F. L. Rose, and I.C.I., Ltd. 23076.

Polishing compositions.—A. Fenby. 22811.

Coating of metal articles.—H. M. Freud. 22986.

Carbonisation of coal, etc.—Gas Chambers & Coke Ovens, Ltd., and F. Ritson. 23160.

Complete Specifications Open to Public Inspection

Synthetic resins.—Soc. L'Impregnation. January 24, 1940. 18387/46.

Dry-spinning of solutions of polymerised vinyl compounds.—Soc. Rhodiaceta. August 24, 1942. 25834/45.

Extruded products having a basis of cellulose derivatives and process of their manufacture.—Soc. Rhodiaceta. August 11, 1943. 25835/45.

Method of compounding rubber and product.—Wilmington Chemical Corporation. January 26, 1945. 2551/46.

Plasticised resins.—Bakelite, Ltd. January 30, 1945. 2708/46.

Laminated articles having craze-resistant coatings, compositions for producing such coatings.—British Industrial Plastics, Ltd. January 31, 1945. 957/46.

Preparing crystalline penicillin in the form of its ammonium salt.—Commercial Solvents Corporation. January 31, 1945. 651/46.

Soluble polyvinyl chlorides.—Cie. de Produits Chimiques et Electrometallurgiques Alais, Froges & Camargue. January 31, 1945. 1792/46.

Manufacture of saturated products from natural or treated oils.—Cie. Française de Raffinage. July 4, 1941. 20039-40/46.

Distillation of bituminous limestones.—Cie. Française de Raffinage. September 16, 1942. 20041/46.

Synthetic process for the manufacture of oleaginous products.—Cie. Française de Raffinage. December 19, 1942. 20186-7/46.

Treatment of shale oil.—Cie. Française de Raffinage. April 9, 1943. 20376/46.

Alcoholysis of oils having a high acid content.—Cie. Française de Raffinage. May 21, 1943. 20377/46.

Complete Specifications Accepted

Synthetic resin compositions.—Distillers Co., Ltd., and J. J. P. Staudinger. July 21, 1943. 579,248.

Prevention of corrosion of magnesium and magnesium base alloys.—Essex Aero, Ltd., R. J. Cross, and E. F. Maillard. November 14, 1942. 579,163-4.

Protection of magnesium and magnesium-rich alloys against corrosion.—Essex Aero, Ltd., R. J. Cross, and E. F. Maillard. November 14, 1942. 579,165.

Thermoplastic moulding compositions containing ethyl cellulose.—Hercules Powder Co. June 19, 1943. 579,184.

Catalytic dehydrogenation of hydrocarbons.—Houdry Process Corporation. July 27, 1943. 579,102.

Interpolymerisation of 1, 3-butadienes and methyl methacrylate.—Imperial Chemical Industries, Ltd. September 18, 1941. 579,235.

Method for saccharifying cellulose materials by means of diluted mineral acids.—Les Usines de Melle. March 27, 1941. 579,116.

Volatile deodorising or disinfecting blocks.—B. Lipton. December 15, 1943. 579,199.

Dyeing of textile materials.—Mathieson Alkali Works. December 30, 1942. 579,134.

Rotary fluid pumps, compressors or the like.—A. A. Mercer. September 4, 1944. 579,264.

Ethyl cellulose moulding compositions.—W. H. Moss, and W. E. Cowley. July 23, 1943. 579,250.

Apparatus for cleaning heat exchangers.—C. W. Parris and J. R. Jenkinson. July 17, 1944. 579,141.

Refractories.—Permanente Cement Co. June 14, 1943. 579,098.

Manufacture of lactones.—Soc .of Chemical Industry in Basle. Cognate applications 4274/43 and 4275/43. March 16, 1942. 579,169.

Method for ageing solutions of colloidal material from which artificial filaments and like materials may be spun and apparatus therefor.—R. H. K. Thomson, W. Sever, and I.C.I., Ltd. April 28, 1944. 579,089.

Ceramic pigments.—W. W. Triggs (Harshaw Chemical Co.). April 24, 1944. 579,139.

Manufacture of xanthopterin and related compounds.—Wellcome Foundation, Ltd. April 6, 1944. 579,138.

Treatment of vinyl chloride-vinylidene chloride co-polymers.—Wingfoot Corporation. June 11, 1943. 579,181.

Non-corrosive hydrocarbon fuels and solvents.—C. Arnold (Standard Oil Development Co.). February 9, 1943. (Convention date not granted). 579,369.

Manufacture of barium carbide.—J. G. Bennet, and M. Pirani. (Cognate applications 10547/42, 15715/42 and 10014/43.) July 28, 1942. 579,321.

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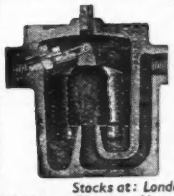

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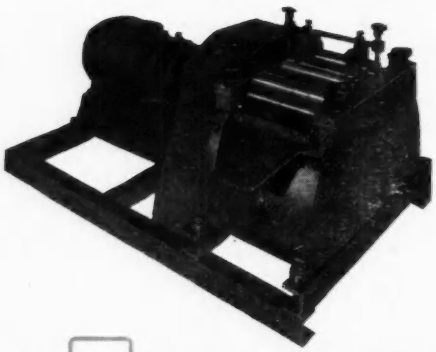

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